PUBLIC WORKS

Nov. 1955

CITY, COUNTY AND STATE

Lateral Sewer Construction Costs . . 71

Standardized Bridges Cut Costs 79

Seven Methods of Iron Removal 81

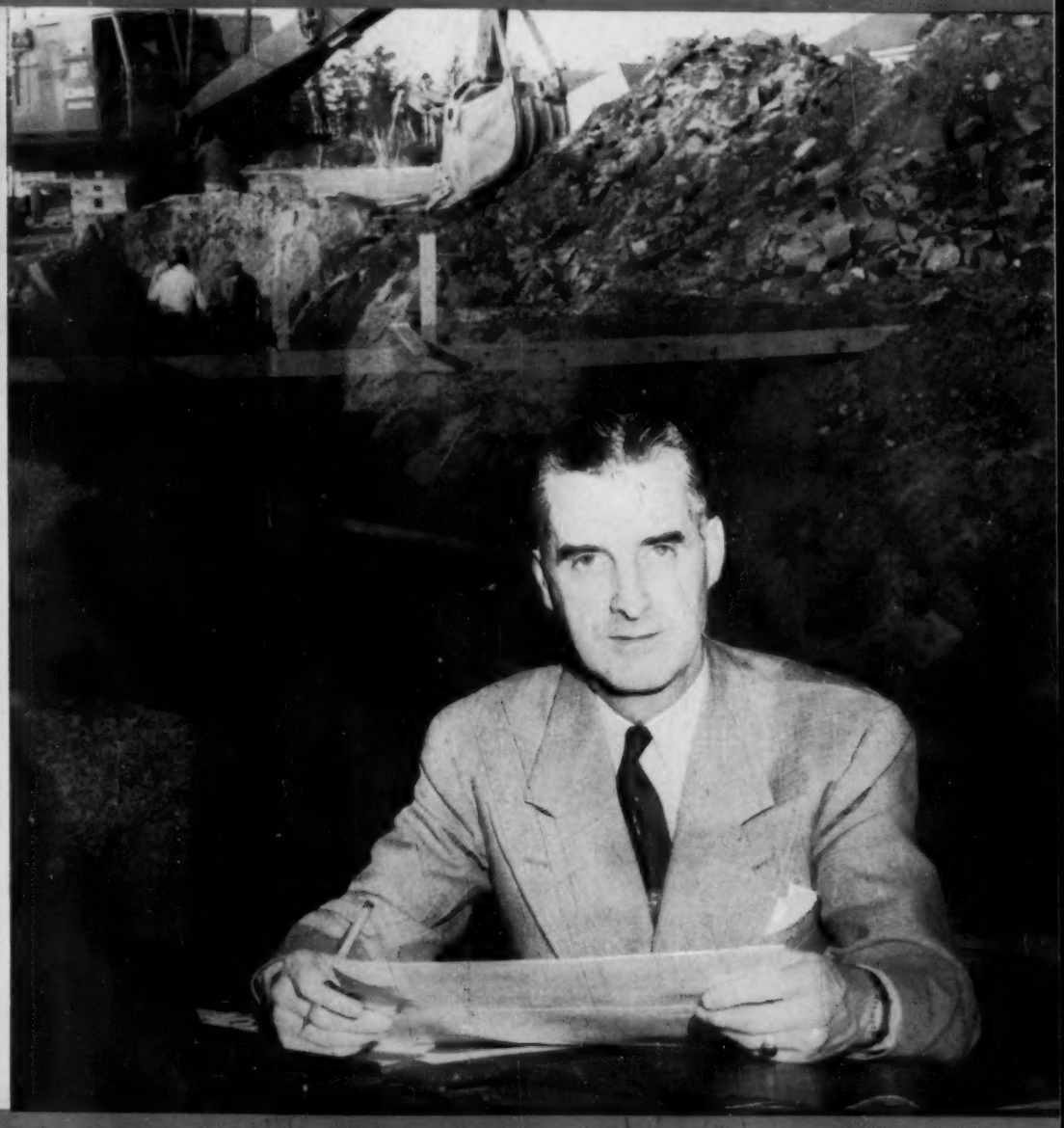
Leaf Composting Pays for Removal 84

Winter Maintenance and Drainage 86

Graphic Panel Type Instruments 91

Irrigation with Waste Water 97

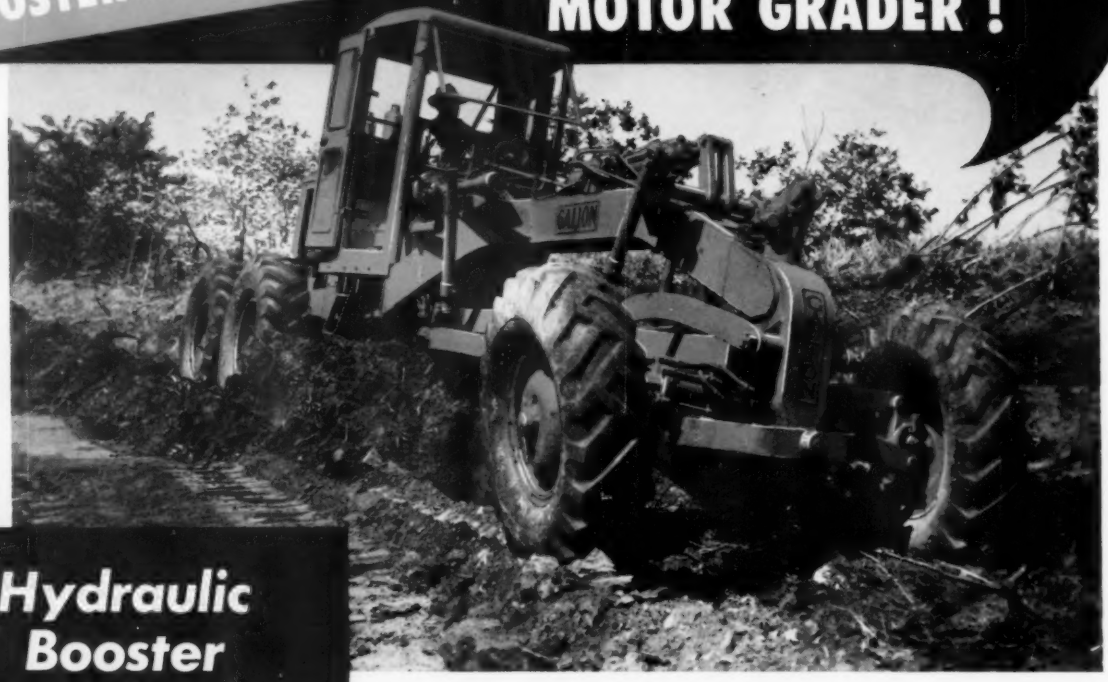
COMPLETE CONTENTS LIST ON PAGE 5



John J. Sullivan, Superintendent of the Department of Streets and Engineering for Springfield, Massachusetts. More data on page 24.

GALION HYDRAULIC BOOSTER STEERING

Less effort to steer a GALION MOTOR GRADER !



Hydraulic Booster Steering is STANDARD EQUIPMENT *on* GALION Models 118, 104, 450 MOTOR GRADERS

Fingertip touch on the steering wheel is all the effort it takes to steer a GALION Grader — because the hydraulic booster does the hard work. Instant, smooth response — no lagging, no surging. Even in the toughest going, the steering wheel doesn't shake or kick — there's no need to "fight" it. Yet the confident feeling of hand steering is retained.

As a result, GALION Motor Graders are easier and more efficiently maneuvered — operators stay fresh and alert all day long — performance is boosted all around. Hydraulic booster steering has for years been STANDARD EQUIPMENT on the larger models of Galion Graders. Write for literature.

B & L ELEVATING GRADER ATTACHMENT

The speedy, low cost method of casting, stripping, loading and terracing.

ESTABLISHED GALION 1907

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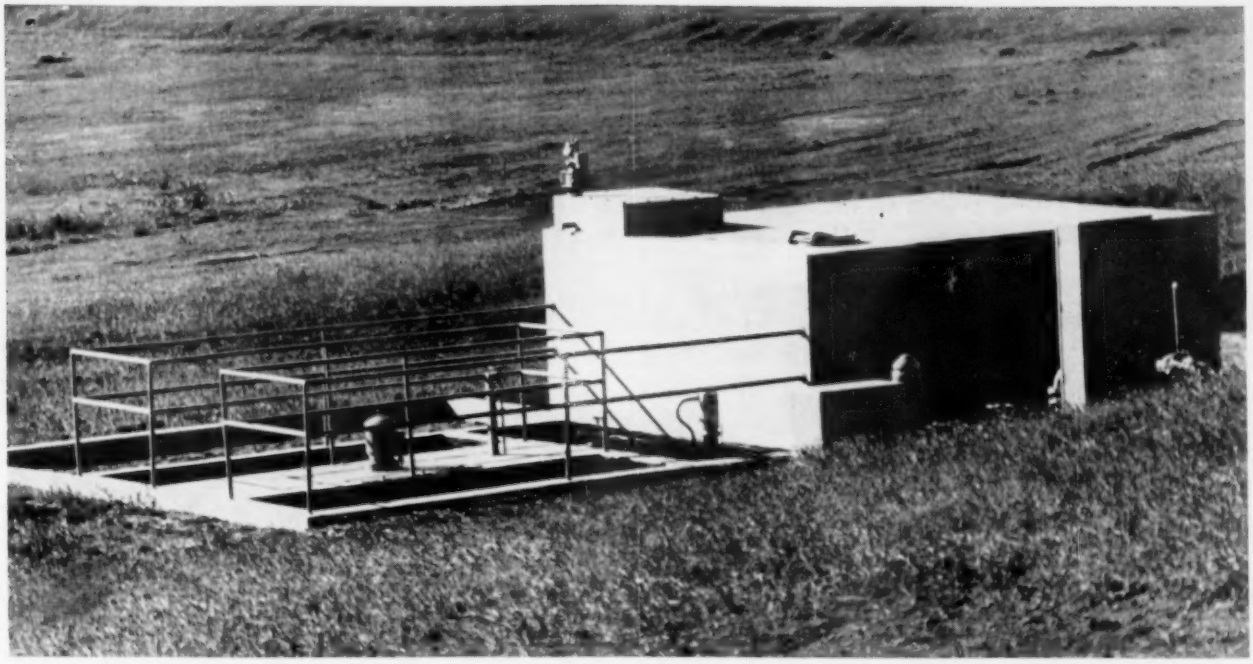
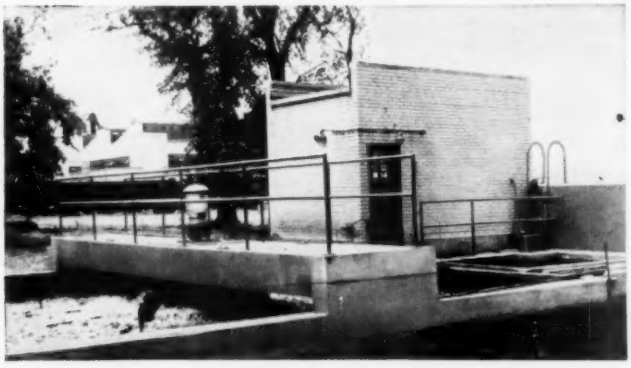


Activated Sludge 'Pakage' Plant at Contra Costa, Jr. College, Contra Costa, California. This 7' unit is designed to treat 15,000 gallons per day. Roy E. Ramseier, Consulting Engineer.

CHICAGO PROCESS EQUIPMENT
for Small, Compact Activated Sludge Plants

Consistently Specified by Sanitary Engineers *for*

- **SMALL COMMUNITIES**
- **TURNPIKE SERVICE FACILITIES**
- **INDUSTRIAL FACILITIES**
- **AIRPORTS**
- **HOSPITALS, SCHOOLS AND OTHER INSTITUTIONS**



Activated Sludge 'Pakage' Plant installed for the Goodyear Tire and Rubber Company Plant, Topeka, Kansas. This 18' unit is designed to treat 125,000 gallons per day. J. G. Turnbull, Consulting Engineer.

OVER 230 IN OPERATION

Activated Sludge 'Pakage' Plants have a proven 21 year record for producing sparkling clear effluent.

Many semi-automatic features simplify operation and assure trouble-free performance under all conditions. 'Pakage' Plants can be operated by men with State Board of Health minimum classifications.

Aeration and clarification are accomplished in a single tank with positive sludge control that covers a wide range of sewage flows and strengths.

'Pakage' Plants handle sewage flows of from 15,000 to 500,000 gallons per day in single or multiple units. They may be safely located near dwellings, as the plants are free of flies, foul odors and unsightly appearances.

Specify Activated Sludge 'Pakage' Plants for proven and trouble-free sewage treatment performance. Write to Department N.

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Subsidiary of Food Machinery and Chemical Corporation
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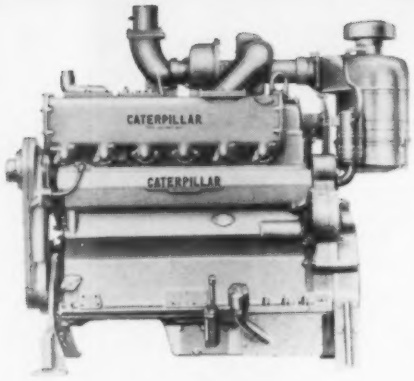
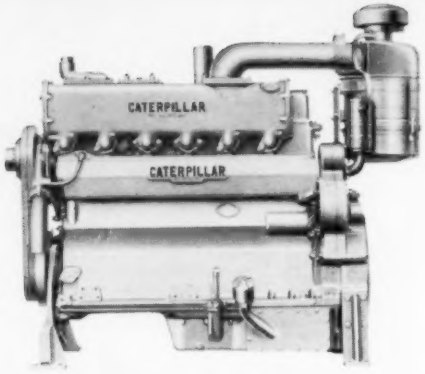


310 HP maximum @ 2000 r.p.m.

THE NEW D326
Series F



200 HP maximum @ 2000 r.p.m.

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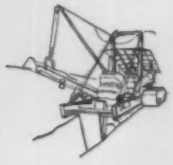

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Available as original power in many types of equipment . . . direct drive or choice of transmissions, including hydraulic couplings and torque converters. Also available as Electric Sets and Marine Engines.

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PUBLIC WORKS MAGAZINE

CONTENTS

NOVEMBER, 1955 **Vol. 86, No. 11**

Lateral Sewer Construction Costs. By *John J. Baffa* 71
Welding Saves Time and Cost on Repair of Ornamental Lamp Posts 78
Standardized Bridges Bring Better Bids. By *William A. Stancer* 79
7 Methods of Iron Removal. By *H. R. Fosnot* 81
Leaf Removal Pays Its Way in Toronto 84
Winter Maintenance and Drainage. By. *H. A. Radzikowski* 86
Graphic Panel Type Instruments for Water and Sewage Treatment Plants. By *R. H. Babcock* 91
Benefits of a Meter Maintenance Program. By *Bennett R. Bolen* 93
Roadside Seeding and Asphalt Mulching. By *James A. Saunders* 94
More Light at Less Cost. By *Phil Hirsch* 96
Irrigation with Waste Water. By *Ralph Stone* 97
Tar Rubber and Asphaltic Concrete Placed for Jet Base Pavement 99
New Wells Assure Water for Montgomery 100
Another One? Out or Down? Where? By *John Gray* 101
Incineration in Ohio Cities 102
Packing Wastes Treated Automatically. By *Edward G. Anderson* 103
Airphoto Interpretation—An Aid in Materials and Route Locations 104
Sea Water Intrusion Studied in California 144
Town Pumps Water Without Power Cost 144

PUBLIC WORKS DIGESTS

The Industrial Waste Digest 112
The Highway and Airport Digest 120
The Water Works Digest 128
The Sewerage and Refuse Digest 136

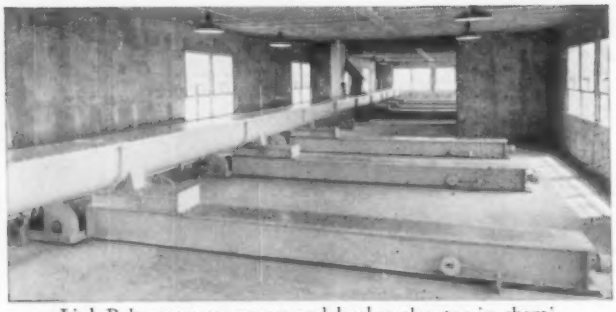
DEPARTMENTS AND SECTIONS

The Editor's Page 7
Letters to the Editor 20
Books in Brief 22
Leader in Public Works 24
The Engineers' Library 32
Washington News 54
Up Front for Adequate Roads. By "Jack" Ritter 62
APWA News 105
New Public Works Equipment 150
Worth Seeing 157
Worth Telling. By *A. K. Akers* 158

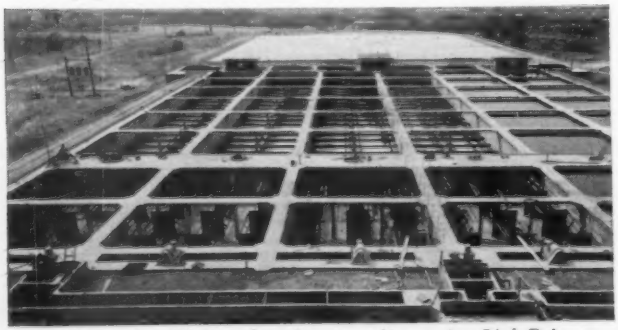
THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

Phoenix plans water treatment for a half-century ahead with LINK-BELT equipment

At Squaw Peak plant, each settling basin has four Link-Belt Straightline collectors with redwood flights mounted on Link-Belt Promal chain. Headman, Ferguson & Carollo, Consulting Engineers, Phoenix, Arizona.



Link-Belt screw conveyors and bucket elevator in chemical building distribute lime or alum to storage bins. Equipment is dust-tight.



Chemical mixing tanks (foreground) employ Link-Belt paddle mixers; primary tanks Straightline sludge collectors and cross collectors. Covered storage reservoir in background.

THE rapid and continuing population expansion of Phoenix, Arizona — 63% from 1940 to 1950 — called for a recent 30-mgd addition to existing filtration facilities. Using Link-Belt chemical and flocculation equipment, this water treatment system can handle 40-mgd in an emergency. From a master plan projected to the year 2000, further extensions can be made with minimum changeover.

Such confidence in the durability and quality of Link-Belt sanitary engineering equipment is justified by successful water, sewage and industrial liquids treatment applications throughout the country. Whether your requirements are large or limited, our sanitary engineering specialists will work with your own engineers, chemists and consultants.

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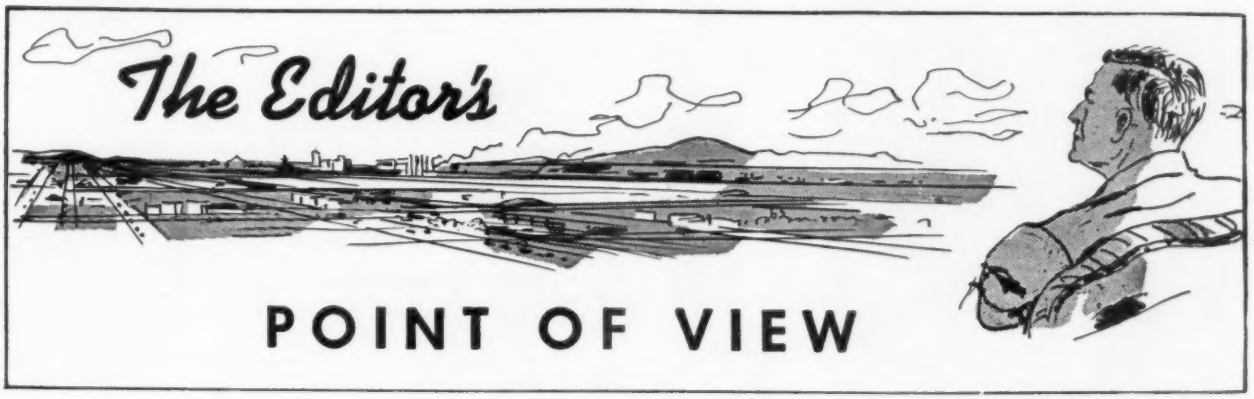


That History of Sanitary Engineering in World War II

INFORMATION has reached us that Vol. VI, Environmental Hygiene in World War II, the history of sanitary engineering and, in large part, of the Sanitary Corps, has been published and is, or shortly will be, available from the Government Printing Office. Such additional information as reaches us in time will be published in this issue, probably well to the rear, as those pages can be held longer than this one. We will supply, at the earliest possible time, information on cost and how to get this volume.

This text is written from the overhead viewpoint and, therefore, contains relatively little information on the detail application of sanitary engineering skills in the field. It was felt that capable engineers will be available and that technical knowledge will be sufficient to solve almost any future problems that may arise; but that neither the men nor the knowledge will be sufficient without a suitable organization at the top level. This organization must have authority and freedom, within military limitations, to permit it to function effectively. Special consideration was therefore given in the text to these factors.

Sewer Construction Costs: An Unusually Valuable Contribution

A MATERIAL contribution to public works engineering has been made by John Baffa, consulting engineer, in his analysis of sewer construction costs which appears in this issue. It has been our privilege to cooperate, along with several hundred of our readers, in obtaining the basic data which have been translated into the series of fine charts on pages 71 to 77. These are amply large to permit general use without magnification; they can be useful in checking costs, in preparing estimates, and in many other ways. Since they represent 1954 costs, they will be useful for an indefinite period in the future by reference to some of the excellent construction cost indices generally available.

We invite our readers to furnish us such cost data as they may have which will add to the value of the fine job that Mr. Baffa has done.

Wider Fields of Service and Usefulness for Consulting Engineers

USE of the skills of consulting engineers in the design of our modern highways—the toll roads, the throughways and the parkways—is to be applauded. It was not so many years ago that consulting engineers, with few exceptions, restricted their work to water, sewerage, drainage and refuse disposal. During the war, consulting engineering organizations were utilized to design and supervise the construction of camps, airfields and other war-time projects. We think their use in the highway field can add much-needed speed to our road-building program and that they will do a fine job.

Hurricanes, Floods and Civil Defense

CIVIL DEFENSE organizations effectively demonstrated their great usefulness during the hurricanes and floods that hit the eastern states during August. There have always been plenty of volunteers to offer help in time of disaster, but without organization, equipment and advance planning, their efforts fall short. We need more of the kind of men who are contributing to Civil Defense and we need more governmental support for them, so that they will have more resources with which to alleviate the disasters which are sure to come from time to time in the future.

Maybe There Will Be Some Sanitary Engineering for the Navy Soon

A RECENT Navy publication carries the note that a civilian sanitary engineer, with the grade of GS-14, has been authorized for the Preventive Medicine Division of the Bureau of Medicine and Surgery. We hope this means that there will be some progress in this important and hitherto neglected field. Results will depend alike on the qualifications and characteristics of the engineer and on the understanding of the men with whom he must work. A basic fact is that sanitary engineering is essentially preventive in nature rather than curative; and any sound program must be grounded on this. Regrettably, none of the military services appear to appreciate this, especially as it relates to operations in the field.

Other Mueller Water Works Equipment (a partial list)

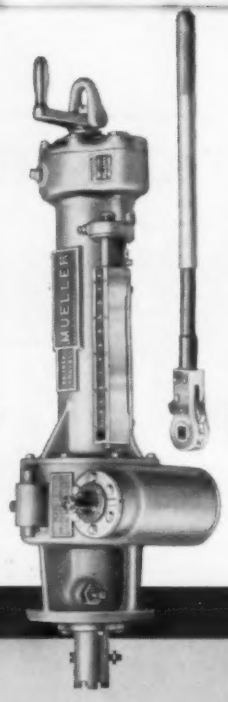
CURB BOXES

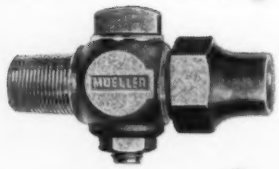
CHECK VALVES

RELIEF VALVES

DRILLING MACHINES

COMPRESSION STOPS





Corporation Stops

Ground key construction . . . designed for insertion into mains under pressure . . . precision fitted and individually lapped into body . . . complete range of sizes . . . variety of inlet and outlet threads and connections.

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Hand operated or power-operated with gasoline engine or air motor . . . drills 2″ through 12″ in any type or size main . . . automatic tool feed . . . working pressure to 500 p.s.i. . . . smaller drilling machines available with varying capacities up to 2″.

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TAPPING VALVES

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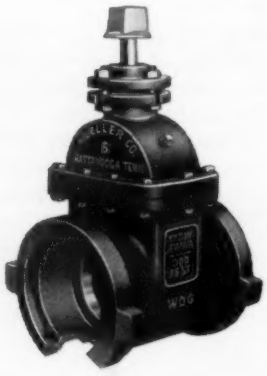

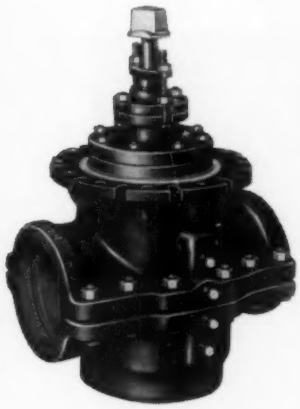

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Designed for adding needed control valves without hazardous shutdown . . . quickly installed in line under pressure . . . operated like standard gate valve . . . working parts interchangeable with AWWA gate valve . . . sizes 4", 6" and 8".

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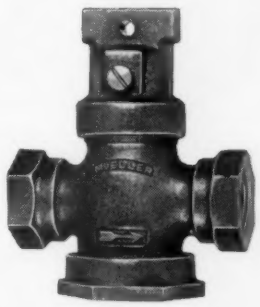
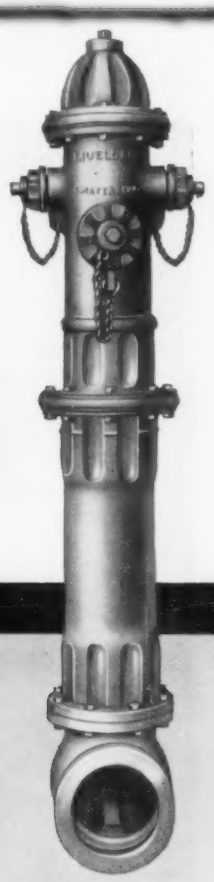
Ground key construction . . . precision fitted and individually lapped . . . proper taper of key assures easy operation and long life . . . inverted key or solid head type . . . complete range of sizes, types and connections.





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Improved design incorporates all the latest hydrant features . . . compression-type main valve . . . safety flange and stem coupling . . . "O" ring stem seals . . . self-oiling reservoir . . . double drain valves . . . dry top design . . . now available with "Ring-Tite" inlet connection.

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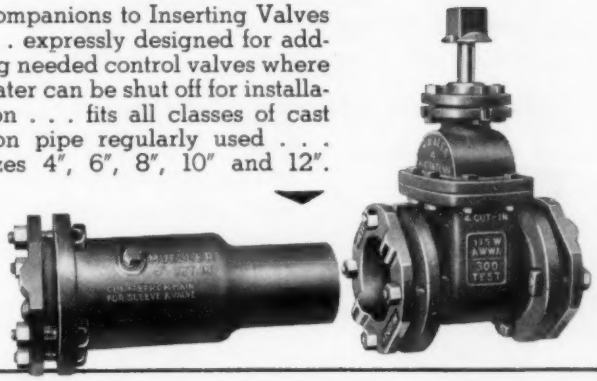
"B" Tapping Machine

Drills and taps mains and inserts corporation stops, ½" through 1", under pressure . . . will dry tap ½" through 2½" . . . working pressure to 230 p.s.i. . . . similar machine available for inserting corporation stops through 2".

Cut-In Sleeves and Valves

Companions to Inserting Valves . . . expressly designed for adding needed control valves where water can be shut off for installation . . . fits all classes of cast iron pipe regularly used . . . sizes 4", 6", 8", 10" and 12".



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FIRST IN ANY 1956 BUDGET!

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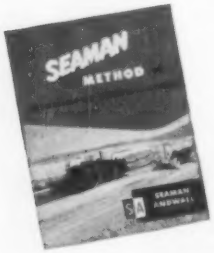
FOR MORE MILES OF QUALITY STABILIZATION...WITH LESS INVESTMENT

HIGHER DAILY OUTPUT of the PULVI-MIXER (generally a mile a day of stabilized roadway 22 feet wide) puts the roadbuilder well ahead of normal schedules. The same high production levels apply equally to city street construction. And in both cases, handicaps imposed by adverse weather are greatly minimized.

QUALITY BASE CONSTRUCTION is assured because the SEAMAN mixes, properly assembles and completely blends the materials. Voids are filled with fines which in turn securely mortar-in the coarser gradations of aggregates. Upon compaction the SEAMAN-mixed base achieves higher load bearing values and remains maintenance-free for years.

LESS INVESTMENT in purchase price and low operating cost are marked advantages to the Self-Propelled PULVI-MIXER owner. In fact, the SEAMAN is so outstandingly efficient that the initial investment is usually repaid within the first few weeks of operation. Check these facts with the SEAMAN distributor — and then put a PULVI-MIXER in your 1956 budget.



This Seaman Bulletin describes the Pulvi-Mixer and TRAV-L-PLANT operation with special emphasis on their use in bituminous construction. Send a postcard today. Ask for Bulletin TPS.

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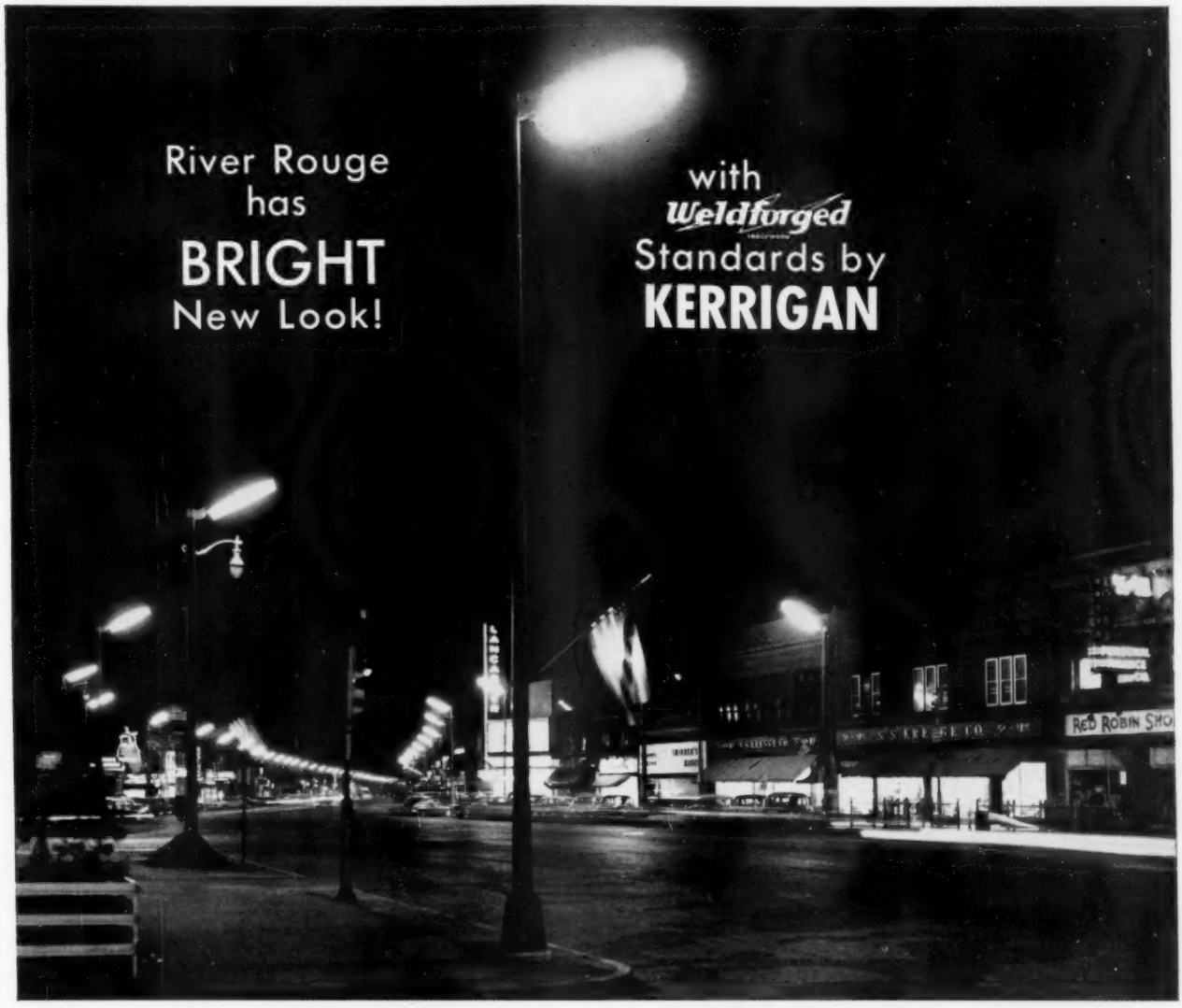
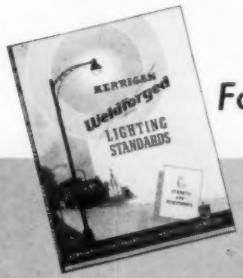


RIVER ROUGE, Michigan citizens are seeing their city in a new light now that their modern, fluorescent street lighting system is in operation. The new lights have more than doubled night visibility, making River Rouge one of the best lighted cities in Michigan.

The bright new look is made possible by aluminum fixtures, each holding four 100-watt fluorescent tubes encased in plexiglass, and the beautiful, continuous tapered, octagon shaped Kerrigan Weldforged lighting standards, made from J&L's low-alloy, corrosion resistant steel. If your city is in need of modern street, highway, park, or bridge lighting, we invite you to consider Kerrigan, the lighting standard fabricated to weather both the elements and the years. Write now for new catalog.



For better lighted city streets the standard is Kerrigan!

KERRIGAN IRON WORKS, INC.

NASHVILLE, TENNESSEE

General Sales Office 274 Madison Ave. New York City

When the job calls for a

Cast iron pipe water line installed in front of Marshall Field's in Chicago during subway construction.

Installing mechanical joint cast iron pipe to carry mine water for an Alabama Coal Company.

Rugged *is* the word for cast iron pipe. When you stop to think that cast iron water and gas mains—cast without benefit of modern metallurgical science and production skills – are in their *second century* of service in over sixty American cities, you agree that rugged *is* the word for cast iron pipe. Then, take note of the fact that *modernized* cast iron pipe, centrifugally cast, is even tougher, stronger and more uniform in quality, than the product of a century ago. For further information, write Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

24-inch mechanical joint cast iron pipe for gas supply line at Skokie, Ill.

CAST IRON PIPE

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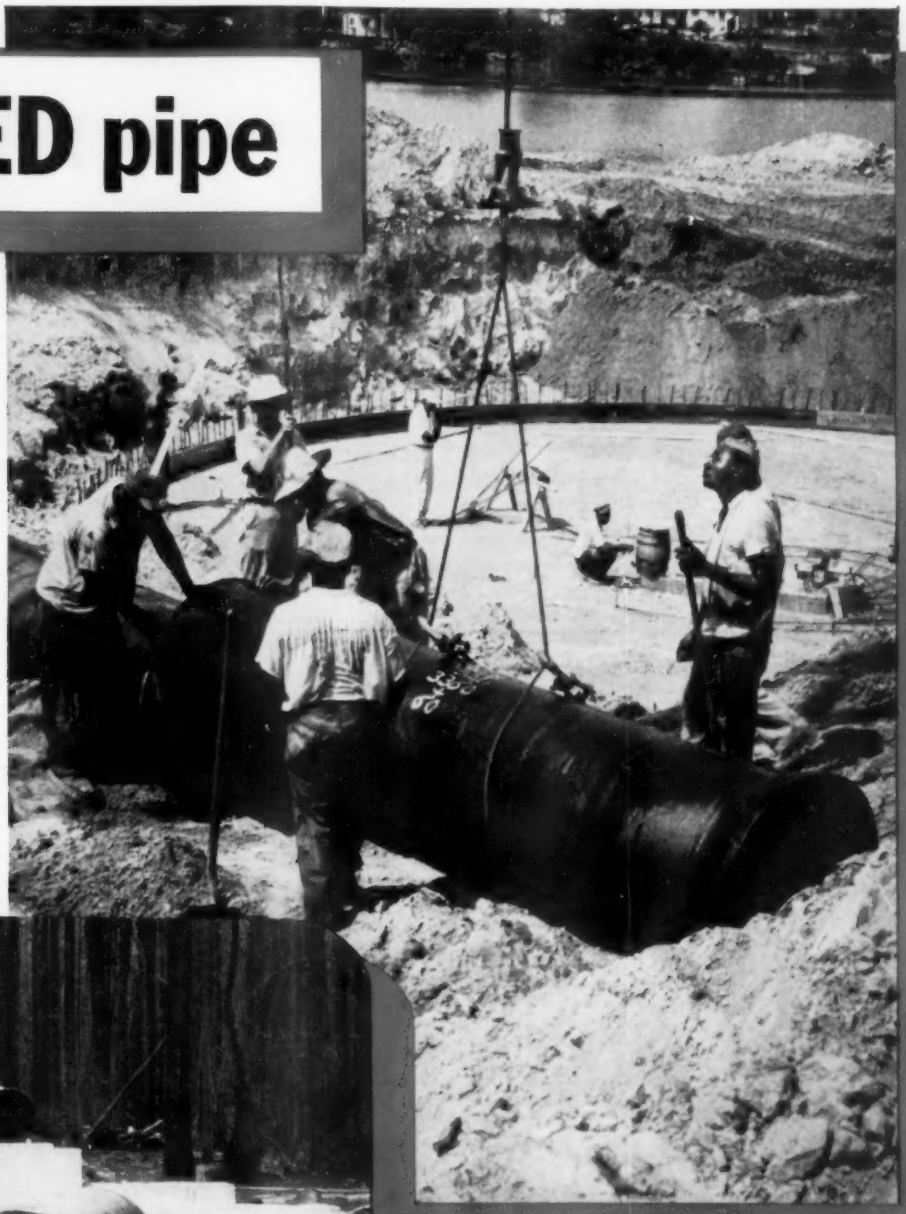
RUGGED pipe



Laying 30-inch cast iron pipe for sewage treatment plant at Panama City, Florida.

Cast iron pipe line on piers to maintain grade from sewage treatment plant to outfall—at Durham, N. C.

SERVES FOR CENTURIES...

Now's the time to mail this month's Readers' Service Card.

NOW You Can Meet Your Sewer Pipe Requirements **BEST** from **EVERY ANGLE**

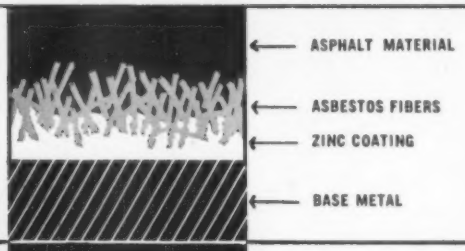
Armco **SMOOTH-FLO** Sewer Pipe Combines

Top Flow Capacity
Proved Material Durability
Corrugated Metal Strength
Watertightness

Here in a single structure—Armco SMOOTH-FLO Sewer Pipe—you can get all the qualities you need for efficient sewer design and performance.

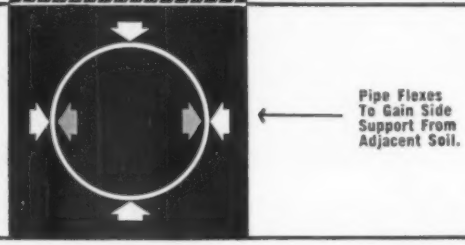
TOP FLOW CAPACITY

A centrifugally applied bituminous lining provides top flow capacity. The diagram shows how the full lining fills the corrugations to provide smooth, efficient interior.



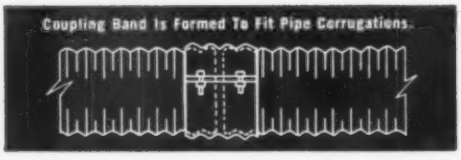
PROVED MATERIAL DURABILITY

The special-grade bituminous lining withstands heat or cold without damage. The base metal itself has extra protection from corrosion. Millions of asbestos fibers are embedded in the zinc coating and sealed with a special saturant. The result is Armco ASBESTOS-BONDED, a material that has been proved in the most severe sewer service.



CORRUGATED METAL STRENGTH

Armco SMOOTH-FLO Sewer Pipe has the flexible strength of corrugated metal design. It deflects under load and builds up side support from the adjacent soil. Thus loads are distributed around the entire periphery, eliminating the danger of cracking, breaking or crushing.



STRONG, TIGHT JOINTS

Bolted band connectors make joints strong and tight. There is no silting or entrance of ground water to overload sewers and treatment plants. Strong joints also mean good alignment year after year.

Write us for more data, prices and delivery time. Armco Drainage & Metal Products, Inc., 6225 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO®

Armco Smooth-Flo Sewer Pipe

Get full details of this month's products . . . mail your Readers' Service card today.

Now's the time to mail this month's Readers' Service Card.

HERE'S

more performance

more versatility

more dependability

than you've ever seen in a 45-drawbar-hp tractor!

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

more performance . . .
FOR SUSTAINED HIGH OUTPUT!

more versatility . . .
FOR A WIDER RANGE OF WORK!

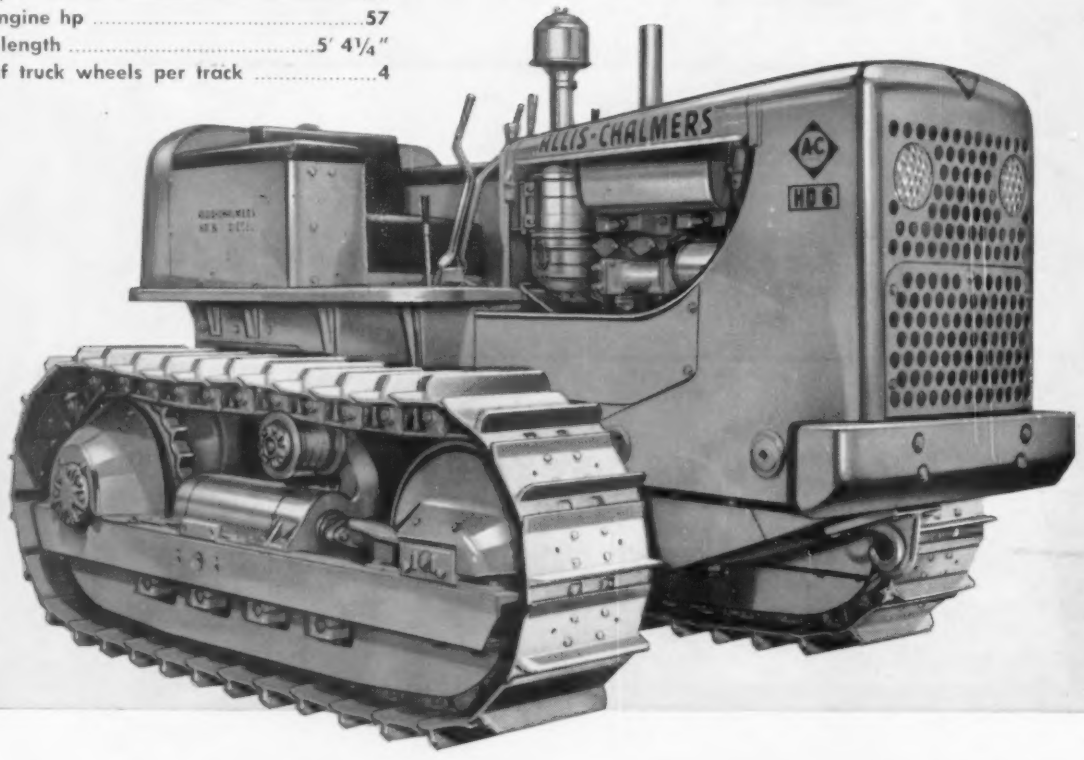
more dependability . . .
FOR LOWER JOB COSTS!

TWO NEW

HD-6

BULLDOZER-DRAWBAR TRACTOR
. . . an all-round tractor balanced for outstanding performance with both mounted and drawn equipment.

Weight	12,400
Drawbar hp	45
Belt hp	55
Net engine hp	57
Track length	5′ 4¼″
No. of truck wheels per track	4



WITH ALL THE IMPORTANT PERFORMANCE ADVANTAGES OF ALLIS-CHALMERS ADVANCED BASIC DESIGN . . .
tested and proved over millions of operating hours!

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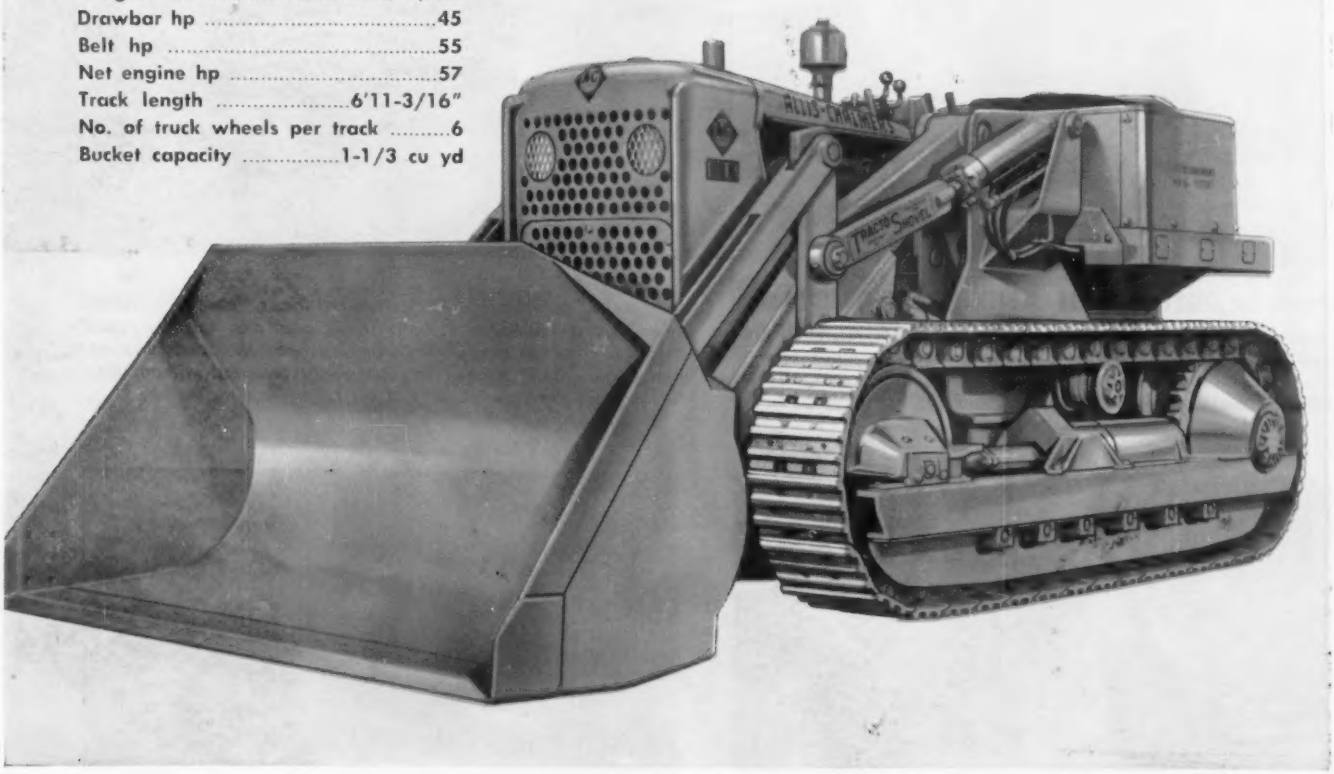
It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

ALLIS-CHALMERS ANNOUNCES HD-6 SERIES TRACTORS

HD-6G

TRACTOR SHOVEL
. . . with the shovel a "built-in" part of the tractor — not just an attachment.

Weight	19,600
Drawbar hp	45
Belt hp	55
Net engine hp	57
Track length	6'11-3/16"
No. of truck wheels per track	6
Bucket capacity	1-1/3 cu yd



The HD-6 series represents the most advanced engineering in the tractor business — not just in features, but in *basic design*. That means plenty of power, balance throughout the tractor, strength in *all* components, weight in the *working* parts where it does the most good, and big safety factors. It also means engineering for the use of mounted equipment, and for easier, better operation and maintenance.

Following are just a few of the many features that reflect this advanced basic design . . . help to bring you higher production, more work done . . . lower job costs.

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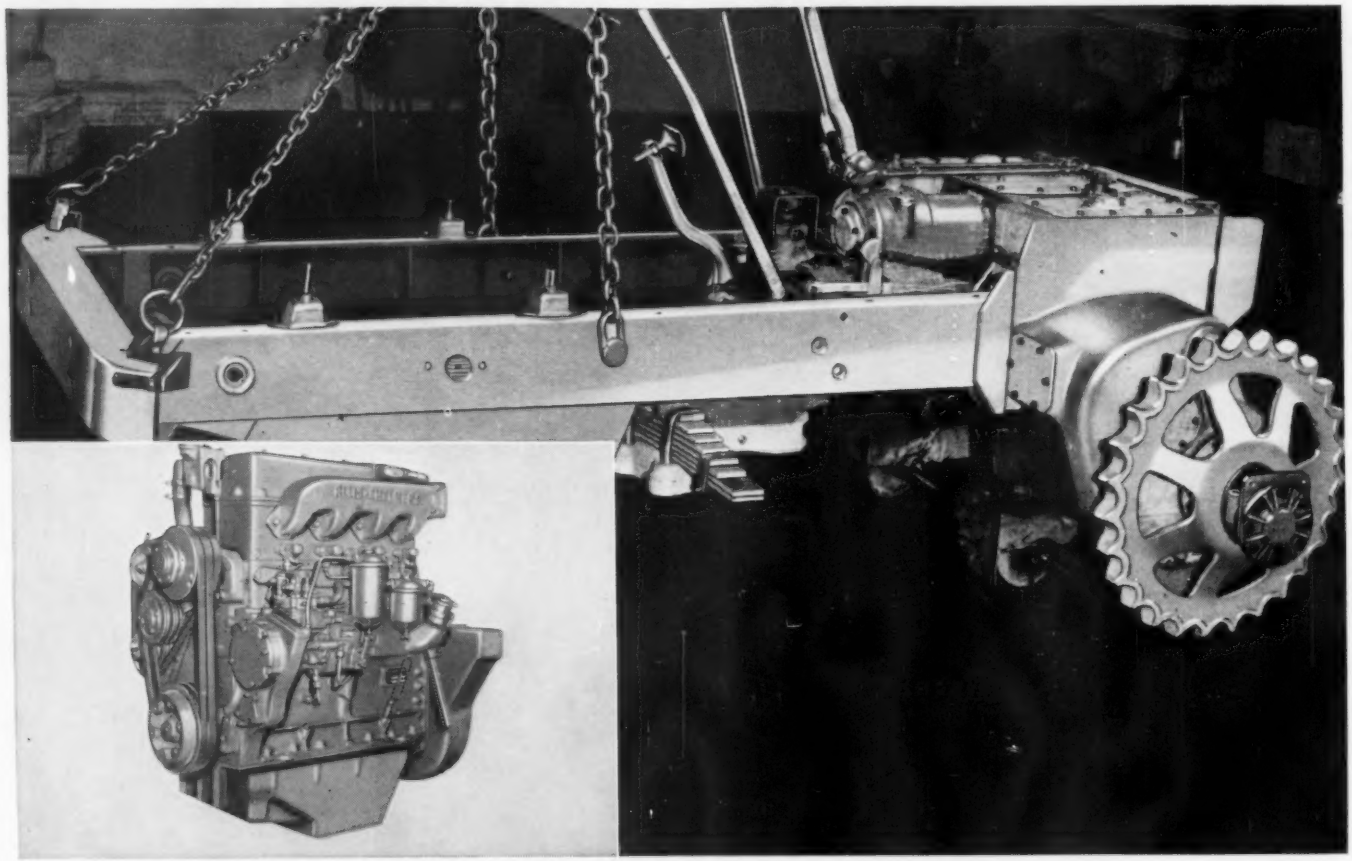
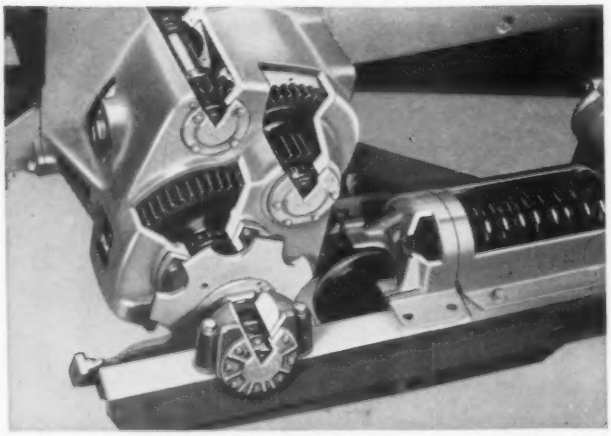
Inside Facts on

NEW ALLIS-CHALMERS HD-6 SERIES TRACTORS



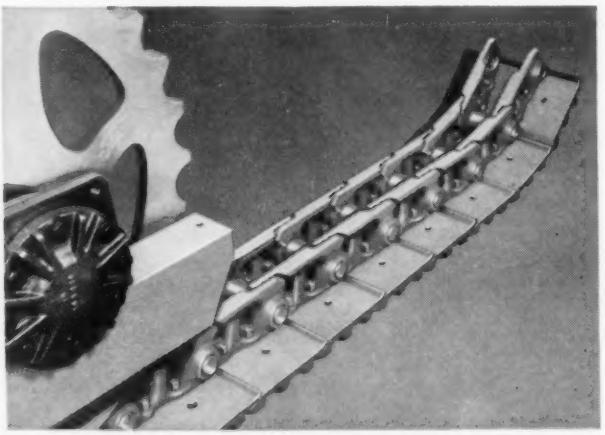
POWER, STRENGTH AND PROTECTION

Here are two important features of the HD-6 series. First, the new Allis-Chalmers diesel, with follow-through combustion — a sure bet for top performance, long life, low upkeep costs. Second, the exclusive all-steel box-A main frame. It protects the entire power train from shock loads, makes possible superior over-all balance, better equipment mounting . . . plus the service simplicity of unit construction. Major assemblies like engine and clutches can be easily removed without disturbing adjacent parts.



STRADDLE-MOUNTED FINAL DRIVE GEARS

Tapered roller bearings support both ends of the final drive gear shafts. With smaller gears and shorter shafts (plus line-bored, one-piece case), that means better bearing and gear alignment, more strength, longer life . . . even with the big load requirements of today's mounted equipment. And *double-reduction* final drives provide greater ground clearance.



NEW-DESIGN, HEAVY-DUTY TRACK

The best available methods in metallurgy and manufacturing are used to produce HD-6 track that will provide long life under the toughest conditions. In addition to new over-all design, HD-6 sidebars benefit from new heat-treating methods which make possible new standards of strength and hardness *throughout* for extra wearability.

Now's the time to mail this month's Readers' Service Card.

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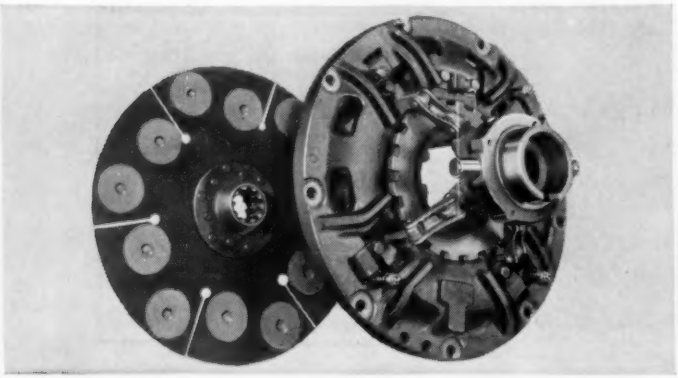
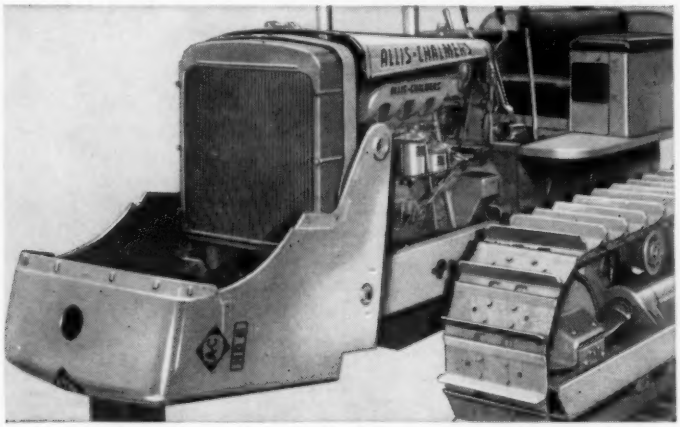
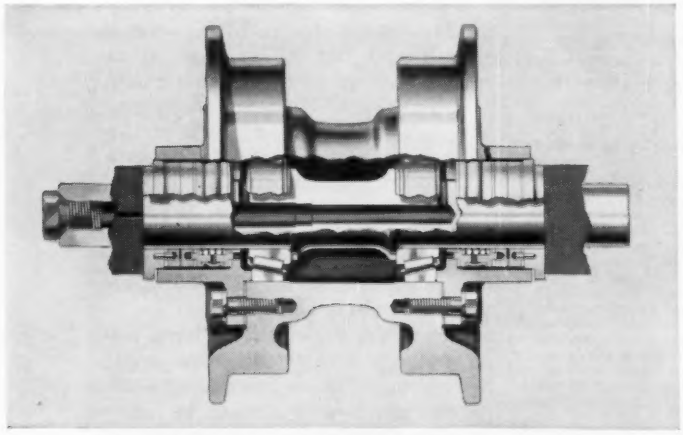


EXTRA CLUTCH LIFE — WITH CERAMIC LINING — The HD-6 master clutch offers simple, single-plate, overcenter design. Revolutionary new *ceramic* button clutch lining keeps clutch operating longer between adjustments . . . lengthens clutch life . . . reduces lever pull for easier operation.



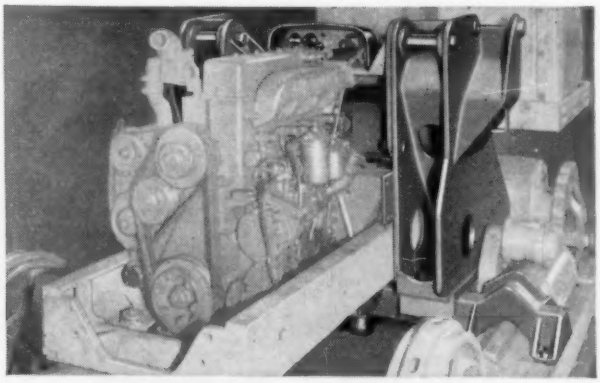
BIG, WELL-PROTECTED RADIATOR

Extra large, one-piece radiator provides all-weather cooling capacity. "Wrap-around" guard enables core to be mounted independently of guard for maximum strength and protection . . . and guard tilts forward for easy service accessibility.



SIMPLIFIED LUBRICATION

Truck wheels, idlers, support rollers need lubrication only once every 1,000 hours . . . because tapered roller bearings let Positive Seals work effectively to keep out dirt and moisture. No lube points under the tractor . . . no lubrication needed more often than every 75 hours. Go from one to two weeks without needing a grease gun.



HD-6G TRACTOR SHOVEL FEATURES

Here's the HD-6G shovel frame mounting assembly. The base of the side frame is mounted in the front to the tractor rigid beam, and at the rear to the truck frame. The upper part is bolted to a heavy steel "stabilizer" forming the cowl of the tractor. Together with the HD-6G's new hydraulic system, it provides greater strength, service simplicity and operator visibility. The HD-6G also offers a new two-position bucket, a two-speed reverse, and has extra long track, with six truck wheels on each side.

FEATURES AVAILABLE *ONLY* IN HD-6

. . . no other tractor in this size class has them — all-steel main frame; one-piece steering clutch and final drive housing; double reduction final drives; welded steel truck frames; roller bearing truck wheels, idlers and support rollers; extra-heavy truck wheels and guards available; Tru-Dimension tracks; wrap-around radiator guards; engine-mounted bulldozers; heavy-duty Allis-Chalmers diesel engine with "follow-through" combustion; rubber engine mounting pads; ceramic button master clutch lining; unit construction; 1,000-hour lubrication intervals for truck wheels, idlers and support rollers; 24-volt direct electric starting (standard); crankcase guard (standard); bumper and lights (standard).

Write now for more facts . . . or see your nearby Allis-Chalmers dealer

ALLIS-CHALMERS
Construction Machinery Division
Milwaukee 1, Wisconsin

Please rush more information on the new HD-6.

☐ Bulldozer-Drawbar Tractor ☐ Tractor Shovel

Name .....

Title .....

Company .....

Address .....

City ..... State .....

PW

ALLIS-CHALMERS

Get full details of this month's products . . . mail your Readers' Service card today.

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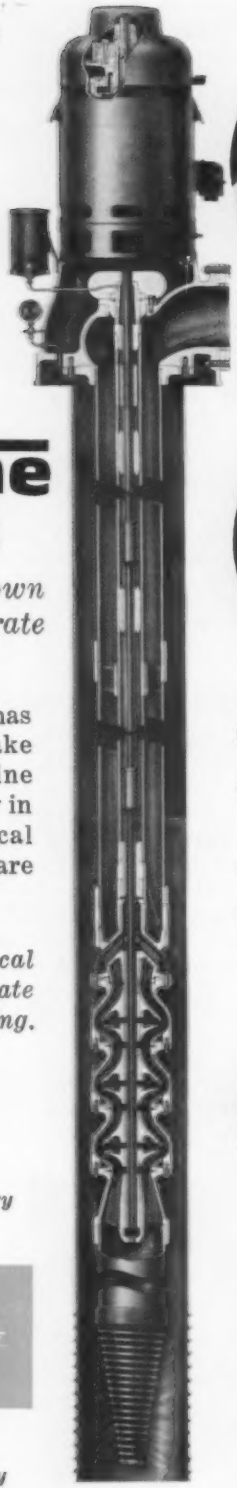
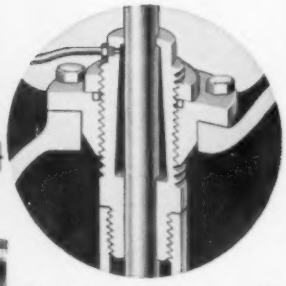


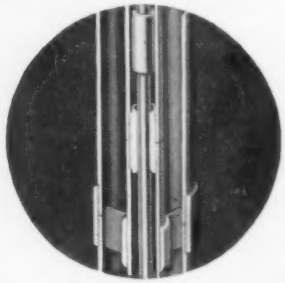


This easily accessible assembly provides means of putting tension on oil tubing, making a rigid, taut, non-vibrating bearing and shaft enclosure.

Verti-Line
PUMPS
are economical to own
— economical to operate

Feature after feature has been designed to make the Verti-Line Turbine Pump today's best buy in vertical pumps. Typical construction features are illustrated.

Whatever your vertical pump needs, investigate Verti-Line before buying.



1. Butt-joint column pipe is usually furnished in 10 ft. lengths.
2. Sleeve type pipe couplings are standard. Flanged type also available.
3. Reinforced rubber enclosing tube supports assure alignment of oil tube and are spaced as specified by Layne & Bowler engineers.
4. Extra long, special alloy bronze bearings are spaced at 5 ft. intervals.
5. Lineshaft is of highest quality steel, turned, ground and polished. Tested for accuracy within .002 in. High tensile strength assures greater safety.

in all industry

on the farm

for the city

1. Either radial vane or mixed flow type impellers are supplied depending on service and conditions.
2. Oversize pump shafts eliminate deflection, whip and vibration, resulting in longer bowl life.
3. Perihedral seal combines vertical cylindrical and horizontal surface impeller sealing. Shaft stretch due to pressure change is not critical, because of vertical cylindrical seal. However, adjustment for wear to restore original capacity is easily accomplished by means of an adjusting nut in the top of the driver that brings into action the horizontal part of the Perihedral seal — an exclusive Verti-Line feature.

Send for your free copy of our new booklet, "Pumps For Sale." Ask for Bulletin U-115

Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY
general offices and main plant
2943 VAIL AVENUE • LOS ANGELES 22, CALIFORNIA

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

CEMETERY OPERATIONS

We operate two cemeteries at a cost of $11,000 per year and receive a revenue of $2,500 per year from sales of lots. Our population is 7000 people. Large cities would probably have tremendous operation and maintenance costs. Do you know of any cities whose cemeteries are self-supporting, or nearly so? How is it that private corporations can return a profit on cemetery operation and cities apparently can not? Is this not a subject on which information needs to be given to municipalities? Any information which you can give us on this subject will certainly be appreciated.

A. B. Uzzle, Jr.
City Manager,
Dunn, North Carolina

Editor's Note: Perhaps some of our readers will forward information on their cemetery operations to Mr. Uzzle. We will be glad to have copies of their replies.

SLOW SAND FILTERS

I have been back from my duty in Guatemala for a little over a month now, but it has been so hot out here that I have not done much.

The school at Guatemala City and the visit to the water plants of the students afterward were interesting and instructive experiences. I saw nine plants in Guatemala, three in Honduras, two in El Salvador, one in Panama, four in Costa Rica and one in the Canal Zone. I had seen the latter plant twice before.

Out of the experience I have renewed my interest in slow sand filter plants. There seems to be no reason why water cannot be adequately clarified before applying it to the slow sand filter; and the simplicity of the slow sand filter has much to recommend it, especially for small plants where spare parts and replacements are hard to get. (*Turn to page* 22)

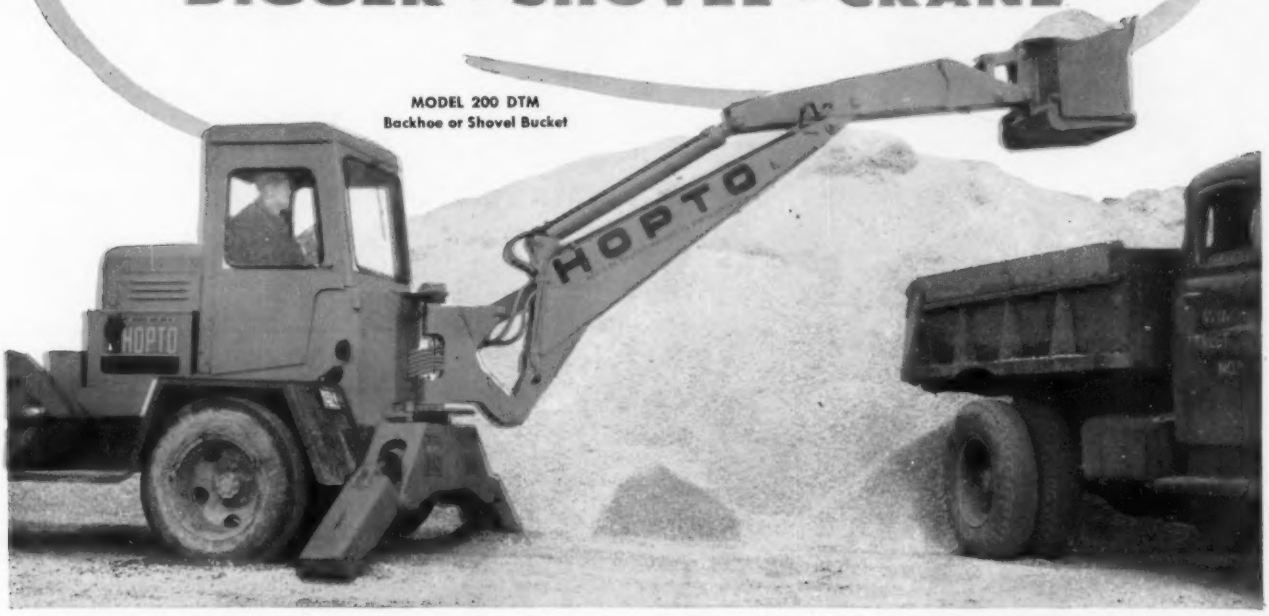
Get full details of this month's products . . . mail your Readers' Service card today.

get set for more work with lower equipment investment

HOPTO

DIGGER • SHOVEL • CRANE

MODEL 200 DTM
Backhoe or Shovel Bucket



FAST CYCLING . . . HYDRAULICALLY OPERATED . . . EASILY MASTERED!

HOPTO Model 200 DTM illustrated above mounts on any 1½ ton or larger truck. This low-cost, big-capacity, versatile unit gives you a power shovel, crane and backhoe at *low equipment investment!*
HOPTO is completely hydraulic. Four levers give fatigue-free operation of this fast-cycling, 200° swing unit. The dipper stick extension mounting on the bucket gives 135° tilt. HOPTO digs 11½ feet below surface; lifts 13½ feet high with shovel bucket, more than 9 feet high with backhoe.
Alloyed steel hardened pins and self-aligning bearings at all pivot points, magnetically filtered oil, double wire braided hydraulic hoses and the elimination of all cables, sheaves and pulleys assure longer life, lower maintenance!

MODELS FOR EVERY NEED!

Badger manufactures a complete line of earth digging equipment from the large capacity, continuous Badger Trencher to the following models of the HOPTO Digger: Power take-off operated and self-powered trailer-type models, two models for mounting directly on any 1½ ton or larger truck, models for rear mounting on track-type of wheel-type tractors, a complete self-propelled track-type unit and the complete Model SPR unit shown below. All HOPTO units incorporate the completely hydraulic operation and the heavy-duty engineered features that make HOPTO the standard of comparison!
A wide variety of attaching equipment adapts HOPTO for any shovel or backhoe work. Half shell and skeleton type buckets and backhoes are available in a variety of widths for every application. Buckets are equipped with HL teeth.
Get all the facts and you'll get HOPTO!

BADGER MACHINE CO.

DEPT. P WINONA, MINN.

WRITE FOR FREE FOLDER GIVING COMPLETE INFORMATION

MODEL 185 SPR
Backhoe or Shovel Bucket

Need more facts about advertised products? Mail your Readers' Service card now.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Read how FITCHBURG CHIPPER SOLVES BRUSH DISPOSAL County of Bergen, N. J.

OFFICE OF SUPERVISOR OF ROADS
COUNTY OF BERGEN

J. ERNEST THIER, SUPERVISOR
DIAMOND 2-1390

70 ZABRISKIE STREET
HACKENSACK, N. J.

May 26, 1955

Mr. W. O. Forman, President,
Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.

Dear Mr. Forman:

I thought I would take five minutes out to inform you about the efficient work your Fitchburg Chipper is doing in Bergen County.

As you probably well know, this Department maintains 450 miles of County road, much of it in the rural area, and formerly, when cutting brush, we had to use a large dump truck and three men to load it, and we were then faced with the problem of disposing of this brush, which was a job in itself.

Since purchasing the Fitchburg Chipper we only need one or two men and a pick-up truck to haul it, and we are not faced with the problem of disposing of this roadside brush, as the wood is now chipped along the roadside to form a soil-improving mulch.

Yours very truly,

Supervisor of Roads.

Free Booklet

Perhaps the savings in man hours and equipment mentioned by Mr. Thier in his letter may apply to your city, town or department.

For further information on how a Fitchburg Chipper can benefit your operation, send for FREE BOOKLET: *Fitchburg Chippers—Real "Brush Eaters"*. Address Dept. PW-115

FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

Thousands use our Readers' Service card to keep up to date . . . do you?

Item: Suggest that the next edition of your textbook include a good deal more material on slow sand filters and their management, cleaning etc. I think we have put far too little emphasis on slow sand filters in recent instruction. The result is that everyone wants to build rapid sand filter plants in places where they should not be built at all. Every young engineer who comes to the US for training has in mind to build rapid sand plants when he goes home.

I am thinking about sending a questionnaire to slow sand plants in the US to ask about cleaning methods. But I am of the opinion that conditions here may dictate a type of cleaning that is not necessary where there is plenty of hand labor.

Jack J. Hinman, Jr.
Iowa City, Iowa

BOOKS IN BRIEF

RADIANT HEATING AND SNOW MELTING

"Radiant Heating and Snow Melting for Airport Installations" is the title of this catalog which gives complete information on convective and radiant heating. Illustrating the catalog are plenty of photographs and photomicrographs. A list of basic cost-governing factors, a review of the chemical and physical properties of wrought iron and a discussion of commonly used piping materials are included. Copies free from Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa.

NEW APPRAISAL AND VALUATION MANUAL

The American Society of Appraisers has just published its 1955-56 "Appraisal and Valuation Manual", a 445-page volume that comprises the combined know-how and cumulative experiences in the field by experts who cover a wide range of appraisal situations. Contents include such fields as Real Estate, Architecture, Building, Public Works, Engineering, Insurance, Accounting, Law, Taxes and Assessments, to cite but a few. Among the topics covered are, Valuation of Chain Store Locations, Shopping Centers, Motels, Freeways, Farm Acreage and Crops, Personal Possessions and the work of appraisers in legal cases. American Society of Appraisers, 100 West 42nd Street, Suite 311, New York 38, New York. Price $15.00.

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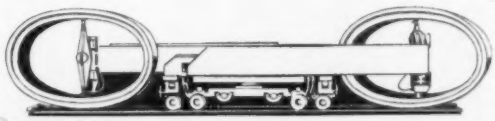
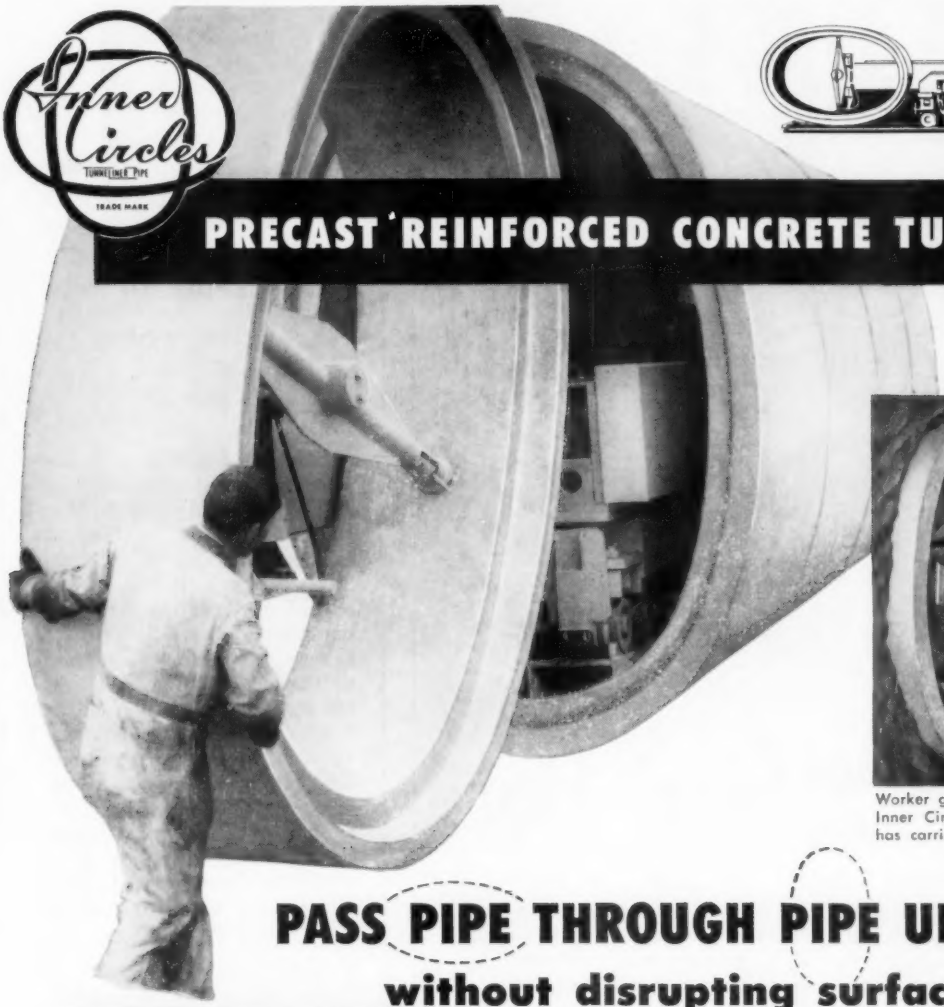
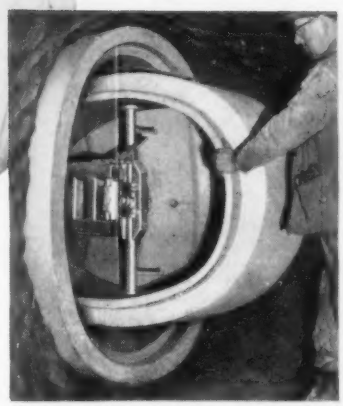
Inner Circles
TUNNELINER PIPE
TRADE MARK



PRECAST REINFORCED CONCRETE TUNNEL PIPE





Worker guides an oval-shaped section of Inner Circle pipe which the Tunnelugger has carried through conduit already laid.

PASS PIPE THROUGH PIPE UNDERGROUND
without disrupting surface traffic!

The Tunnelugger backs off with the pipe still on the arms to set it firmly in place, assuring an even, tight joint.

Inner Circles methods using elliptical Tunneliner pipe now make it possible to pass full structural ring, precast, concrete pipe through conduit already laid—even on curves. Surface excavation is eliminated...traffic is undisturbed...work progresses regardless of weather conditions. Less equipment and fewer laborers are required, yet sewers are completed faster at less cost, with pipe strengths *pretested* by commercial laboratory procedures.

The new two-way Tunnelugger can operate in either direction from a centrally located shaft—quickly delivering and positioning Inner Circles at either end while digging continues at the other.

Our technical staff will be pleased to assist you with your pipe problems.

A-M

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION

GENERAL OFFICES: AMERICAN-MARIETTA BUILDING, 101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS • PHONE WHITEHALL 4-5600

DIVISIONS AND SUBSIDIARIES

B. C. Concrete Company, Ltd.
Concrete Conduit Company
Concrete Products Co. of America
Lamar Pipe and Tile Company
Lewistown Pipe Company
Universal Concrete Pipe Co.

Now's the time to mail this month's Readers' Service Card.

Get All The Advantages With Ferri-Floc

You can depend on Ferri-Floc to give smoother, more efficient and trouble-free coagulation. Whatever your specific water treatment problem may be, you can depend on Ferri-Floc to do the job adequately, efficiently and economically. Ferri-Floc is a free-flowing granular salt which can be fed with a few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy and safe handling as well as storage in closed hoppers over longer periods of time.

WATER TREATMENT

Ferri-Floc coagulates surface or well waters, and it aids taste and odor control. It is effective in lime soda-ash softening, and is adaptable to treatment of practically all industrial water or wastes.

SEWAGE TREATMENT

Ferri-Floc coagulates waters and wastes over wide pH ranges. It provides efficient operation regardless of rapid variations of raw sewage, and is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

SULFUR-DIOXIDE HIGHEST QUALITY SO_2

COPPER TC SULFATE

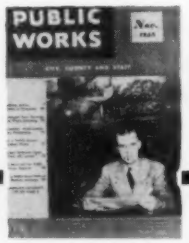
COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

FREE NEW BOOKLET: Let us send you without charge a 38-page booklet that deals specifically with all phases of coagulation. Send postal card to—

TENNESSEE TC CORPORATION

617-629 Grant Building, Atlanta, Ga.

Get full details of this month's products . . . mail your Readers' Service card today.



LEADER IN PUBLIC WORKS

★

James J. Sullivan is Superintendent of Streets and Engineering of Springfield, Mass. He joined the engineering staff of that city in 1923 as a rodman; from 1929 to 1933, he attended Northeastern University and the College of the City of New York. Returning to the service of the city of Springfield, he rose through the various positions until, in 1948, he was appointed City Engineer, Board of Public Works. In the meantime, he served in the Corps of Engineers during the war years, attaining the rank of Captain. He is still a member of the Active Reserve.

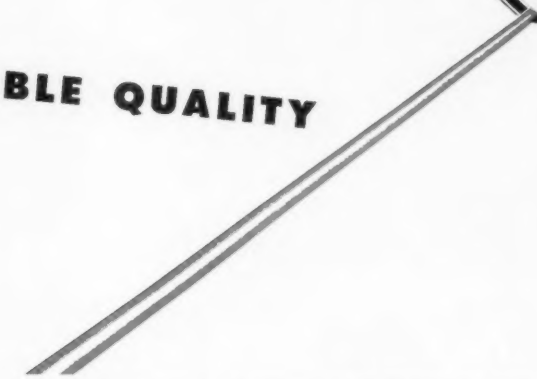
After five years on the Board of Public Works, Mr. Sullivan was appointed Superintendent of the Department of Streets and Engineering and City Engineer. This Department, which he heads, is actually the public works Department and the Superintendent is responsible for the construction of highways and bridges, streets and sewers, and for sewage and waste disposal, plants and structures and for street and traffic light installations, among other things.

Mr. Sullivan has been active in many areas of public interest. He was, at the time of writing this, a candidate for election to the office of Mayor of Springfield. He was recently nominated to be Director of the Municipal and Airport Division of the ARBA. Also, he is active in other organizations. He is married and he and Mrs. Sullivan have three daughters.

Now's the time to mail this month's Readers' Service Card.

"REEL" NEW ADVANTAGES . . .

SAME DEPENDABLE QUALITY



As a user of copper tubing there are two things you want—(1) a product that makes your work easier—(2) a product that is completely dependable.

That's exactly what you get when you specify Wolverine's new flat roll of tube that rolls. Here's why:

Wolverine's round carton rolls like a hoop. *Imagine how this can speed up your work.* In addition, the carton has a convenient center hole so that you can slip it over your arm or shoulder when you want to carry it. Color coding and reversed nomenclature make content identification fast and easy from any angle. It has a zip-quick gummed-tape opening —just a pull of the tape and there's your tube ready to use.

When making an installation all you do is connect the tubing at one end and roll the carton back—*it serves as a reel!* Don't worry about unused tube. It remains in the carton—protected against dirt and damage—right to the very end.

Let's talk about "complete dependability". Wolverine tube is inspected throughout every step of the manufacturing process. It's built to give long life and to provide trouble free installations. It's clean, bright and always easy to bend—in the shop or on the job.

And there they are—good, solid reasons you can count on to make your job easier through "reel" advantages and top product quality. Ask for Wolverine's flat roll of tube that rolls. And remember, always BUY FROM YOUR WHOLESALER. Wolverine Tube, 1427 Central Ave., Detroit 9, Mich.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

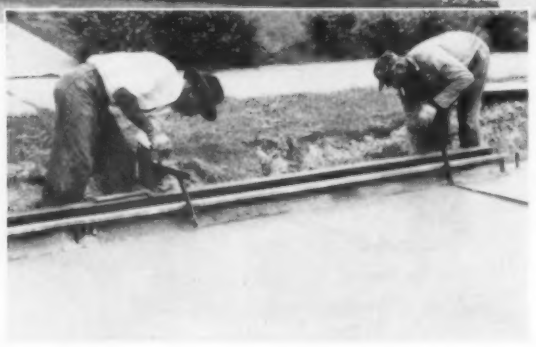
MANUFACTURERS OF QUALITY-CONTROLLED TUBING AND EXTRUDED ALUMINUM SHAPES

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES

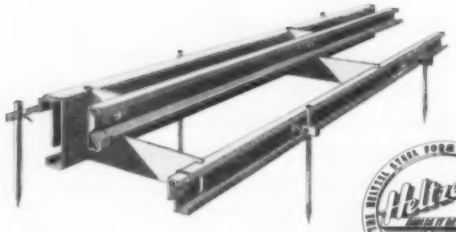
EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

"FOR SIMPLICITY AND SPEED—I'LL TAKE HELTZEL FORMS EVERY TIME" . . . says leading Cleveland Contractor

Joe Galier, of the J. & S. Galier Company, on-the-job with a few of the hundreds of feet of Heltzel Forms he uses daily in his business.



Left—Setting forms perfectly is an easy matter. Many curb and gutter shapes can be worked-out from a simple set of these versatile forms.



"Heltzel has made it a simple matter to get perfect curbs every time," says Joe Galier, one of the principals of the J. & S. Galier Company of Cleveland, O. "It requires only a few minutes to train a worker to set them up."

"We've used Heltzel Curb and Gutter and Sidewalk Forms for many years and, frankly, I've yet to find a better piece of equipment for the job," Mr. Galier continues.

The story's the same wherever you go—leading contractors, like the J. & S. Company, who have tried them all, finally choose Heltzel Forms as the finest available. Next time you're in the market for additional forms why not talk with the Heltzel representative in your area—for the finest costs no more.

THE HELTZEL STEEL FORM & IRON COMPANY

53000 Thomas Rd. • WARREN, OHIO

Thousands use our Readers' Service to keep up to date . . . do you?

DOUBLE PROTECTION*

for icy winter streets

★SALT keeps streets clean and safe

★BANOX® stops salt slush corrosion

Inexpensive . . . Only 1 lb. BANOX needed for every 100 lb. of salt.

Easy to use . . . BANOX needs no special mixing, is evenly distributed by traffic.

Town fathers who add BANOX to de-icing salt are smart because with BANOX in the salt you get the best snow and ice control without the drawback of Salt Slush Corrosion. Many cities now using BANOX have proved its efficiency and economy.

Use the Banox-Salt team because salt is cheaper* and more effective than abrasives. With salt there is no spring clean up of sewers, gutters and catch basins, and BANOX stops salt-slush corrosion, protects cars, trucks, bridges and municipal equipment against corrosion damage.

The amount of BANOX necessary to do a thorough job is small. It takes only a pound of BANOX for every hundred pounds of salt, about 2¢ per capita per year. BANOX in salt will in no way damage concrete, black top or brick pavements.

Get double protection for your town this winter. Investigate the benefits of BANOX. Send for our free bulletin: "Stop, Look and Save with BANOX."

*Comparative cost figures for both city streets and highways indicate that you save as much as $4.27 per mile by using rock salt instead of abrasives.

calgon, inc.

HAGAN BUILDING, PITTSBURGH 30, PENNA.

How Knox County Practices

225 CUBIC YARDS OF REFUSE pours into the disposal site daily from private collectors. There it is picked up by a TD-14A INTERNATIONAL DROTT Bullclam and moved to the gullied area on the farm.

COMPACTING THE RUBBLE is an operation that only requires minutes as the curve on the closed Bullclam blade crushes and irons the refuse into a dense mass.

Bullclam Method of Sanitary Fill operates on self-supporting basis, converts worthless, eroded Tennessee farmland into lush pastures

The Knox County Health Department, Knoxville, Tennessee, uses refuse from an estimated 110,000 population to reclaim eroded farmland near that city.

County officials adopted the Bullclam Method of Sanitary Fill back in 1951. A TD-14A INTERNATIONAL DROTT Bullclam was put to work burying 225 cubic yards of refuse daily, in gullied areas on farms in the southwest section of the county.

Results to date: Five acres of worthless, eroded farmland reclaimed and converted to lush pasture, reclamation work presently under way on gullied section of second farm.

From the outset, the operation has been self-supporting, since a 25-cent monthly fee is collected by the county from each customer serviced by the private collectors.

Whether your community is interested in reclaiming farmland, building playgrounds or industrial sites on marshy areas, or simply in disposing of waste materials safely and for lowest cost, an INTERNATIONAL DROTT Bullclam does the job best. A demonstration by your INTERNATIONAL Industrial Power Distributor will provide proof. Call him today.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS
DROTT MANUFACTURING CORP., MILWAUKEE 8, WISCONSIN

INTERNATIONAL HARVESTER

INTERNATIONAL®
DROTT

Now's the time to mail this month's Readers' Service Card.

Reclamation with Refuse

COVERING THE WASTE is accomplished by application of a two-foot earth seal. Only dirt required for cover coat is excavated and moved swiftly to the fill where it is spread evenly to safeguard against rodents and insects breeding here.

"EASIER TO WORK THAN A KNIFE AND FORK"

Amazing New INTERNATIONAL DROTT 4-in-1 Skid-Shovel Converts Into a

● BULLDOZER ● BULLCLAM ● SKID-SHOVEL ● CLAMSHELL

With the convenient hydraulic control lever, the operator can select the digging tool to suit any type of earthmoving job . . . instantly, while the tractor is in motion or standing still.

Never before has one machine been able to do so many municipal jobs so well and for as little cost as the new INTERNATIONAL DROTT 4-in-1 Skid-Shovel.

Roy Lewis, a superintendent for the McKenzie Construction Company, has been giving the amazing new TD-6 INTERNATIONAL DROTT 4-in-1 Skid-Shovel "the works" for the past several months on a Dallas sewer job and he makes this report:

"It's easier to work than a knife and fork. We've dozed, dragged, hauled, loaded and scraped with it. Even put teeth on the bucket and ripped into hard rock 30 days without breaking a tooth. It's so efficient, I believe it could unbutton your shirt."

See it in action by calling your INTERNATIONAL Industrial Power Distributor. He'll show you how it can be used as a Bullclam for a Sanitary Fill project—and on scores of other jobs your community needs done for lowest cost. The hydraulic "shovel selector" converts it into a Bulldozer, Skid-Shovel, Bullclam or Clamshell . . . right from the operator's seat.

SOMETHING SPECIAL. New INTERNATIONAL DROTT 4-in-1 Skid-Shovel performance on city sewer job prompted superintendent to remark, *"It's far ahead of the times."* Can also be used efficiently on sanitary fill operations.

Get full details of this month's products . . . mail your Readers' Service card today.

CAST TO LAST 100 YEARS

The name "CLOW" cast on the face of cast iron pipe is your guarantee of high quality. This distinctive "autograph" marks the precise, modern production methods, and the advanced, exacting control of quality employed by James B. Clow & Sons, Inc., to assure you the finest cast iron pipe . . . pipe cast to last 100 years.

For more than 75 years waterworks operators and municipal officials have looked to Clow for high quality and good service. Clow cast iron pipe exceeds the physical requirements of all currently approved specifications.

JAMES B. CLOW & SONS

INC.

201-299 North Talman Avenue • Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company, Waterford, New York

Iowa Valve Company, Oskaloosa, Iowa

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

"Thanks to the flexibility of our equipment

we are able to take advantage of changing conditions"

John D. McDonald, *Engineer*
Springfield Sewage Disposal Plant

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AND DEPUTY CLERK

ADMINISTRATION ROOM 4

THE CITY OF
SPRINGFIELD, MASSACHUSETTS

August 27, 1955

Mr. Robert D. Nickerson
Combustion Engineering, Inc.
Raymond Division
200 Madison Ave.
New York 16, N.Y.

Dear Bob:

Inasmuch as we were both involved in that program in Albany and didn't get a chance to talk shop, I thought I should bring you up to date on operations in Springfield.

Although we had been burning all our filter cake for some time past, we recently changed our operation and again produced flash dried sludge. Thus far we have made about 100 tons; a good use for surplus gas. Thanks to the flexibility of our equipment we are able to take advantage of changing conditions.

During the vacation period, the equipment was gone over for the annual checkup and maintenance and not too much work was required to shape things up. It's much better to do this annually and be sure of another year's run without interruption.

In the event that I neglected before, enclosed you will find a copy of the 1954 operating data.

Hoping to see you at the October meeting.

Very truly yours,
John D. McDonald
John D. McDonald
Engineer

McD:egs

COMBUSTION ENGINEERING
RAYMOND DIVISION
1315 North Branch Street, Chicago 22, Illinois
Eastern Office: 200 Madison Avenue, New York 16, New York
Western Office: 510 West Sixth Street, Los Angeles 14, California
Canada: Combustion Engineering-Superheater Ltd.

The C-E Raymond Flash Drying System is the most flexible ever developed. It is available in designs that permit *either* flash drying sewage sludge to a marketable soil conditioner . . . *or* incinerating it to sterile ash—in any proportion and under complete control. In either case, high temperature deodorization of stack gases may be included if you wish.
For details call your nearest C-E Raymond office.

B-866

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

Need more facts about advertised products? Mail your Readers' Service card now.

FREE EQUIPMENT DATA to Help Your PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Bitumuls for Surface Course Mixes

409. New 12-page bulletin describes and illustrates the uses of Bitumuls emulsified asphalt for rapid mixing with economical aggregates in the construction of durable pavements. The bulletin covers typical Bitumuls applications in all parts of the country and a description of laboratory service for proper analysis of aggregates. Copies may be obtained by writing American Bitumuls & Asphalt Co., 200 Bush Street, San Francisco 11, Calif., or check the coupon.

Bulletin on Upright Marking Machines

410. A bulletin just released by the H. C. Sweet Co., 12345 Telegraph Road, Detroit 39, Mich., describes the new Florline upright marking machine. This machine is ideal for those hard-to-get at places because of its lightness of weight, greater maneuverability and its converting to a 2-wheel machine for narrow, crowded areas in a minute. Check the coupon today.

Aluminum used for Roofing and Siding

418. An 8-page bulletin, describing the use of aluminum as roofing and siding material, has just been released by Kaiser Aluminum & Chemical Sales Corp., 1924 Broadway, Oakland 12, California. Aluminum can be used in water and sewage plants and industrial buildings. Complete information on its strength, appearance, corrosion resistance and lightness is included. Check the coupon today.

Valuable Booklet on Ice Skating Rinks

420. An illustrated 32-page booklet entitled "Ice Skating Rinks—Their Construction and Maintenance" is prepared for architects, engineers, arena superintendents and municipal officials. Sections include discussions of corrosion control, types of rink construction, comparative service record data, recommended maintenance procedures and a listing of helpful technical bulletins. Get your copy from A. M. Byers Co., Engineering Service Dept., Pittsburgh 22, Pa., or check the handy coupon.

A Level Surface for Asphalt Streets and Highways

72. The Monatco Heater-Planer gives an asphalt pavement a complete treatment without tearing or gouging to a new table-smooth, nonskid surface and the entire operation is performed quickly and easily. For full data on operation and specifications of this machine write to Monatco Mfg. Corp., 141 Woodland, Kansas City, Mo., or check the coupon today.

Valuable Catalog on Underground Pumping Stations

142. Factory-built underground pumping station with duplex sewage pumps is described fully in catalog just released by Smith & Loveless, Inc., 3427 Broadway, Kansas City, Mo. Information on operating conditions, design of sewage pump stations and force mains, charts and graphs and drawings are included. Also, full details are given on the pneumatic sewage ejector lift station which gives lower first cost, easier maintenance and greater dependability. Get all the facts by checking the handy coupon today.

Helpful Design Data on Steel Joists

134. A complete handbook on the design of standard and longspan steel joists is available from American Bridge Division, U. S. Steel Corp., 525 William Penn Place, Pittsburgh, Pa. Every engineer should have this handbook in his file for design, reference and construction of steel joists. Check the coupon today for your copy.

Lay Water Mains Faster Without Coupling Pullers

184. Get permanent water-tight joints automatically with Century "Fluid-Tite" couplings for Century asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna. or by checking the coupon.

New Bulletin Covers Current Darling Line

235. The latest product developments as well as all equipment items produced by Darling Valve & Manufacturing Co., Williamsport, Penna. for water works services are covered in 48-page Bulletin #5403. Complete data on ball bearing-operated fire hydrant, including detailed design and operating features, range of types, components, accessories, dimensions and installation and maintenance data are given. Check the coupon today.

Acker Drill Supplies Catalog

290. A 40-page catalog containing a very complete and up-to-date listing of all drilling tools and supplies used for soil sampling, foundation test boring, etc. is available from Acker Drill Co., Inc., Scranton, Penna. The catalog describes and illustrates the tools, accessories and supplies used by drillers everywhere. Check the coupon.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 427 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineers in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the coupon.

Armored Concrete Construction Castings

301. A 24-page catalog describing Armored Concrete, which is concrete with the exposed vertical surfaces armored with gray cast iron, has just been issued by Flockhart Foundry Co., 84 Polk St., Newark 5, N. J. Plenty of illustrations, specifications and photographs are used to explain Armored Concrete. Check the handy coupon today.

The Non-Meltable Mastic Waterstop Joint Sealer

337. Information is available on Igas joint sealer that is installed after concrete is placed. It is self-welding, seals durably and seals all types of joints and is suited for all structural materials and for all types of structures. Get full details from Sika Chemical Corp., 35 Gregory Ave., Passaic, N. J. or check the handy coupon.

Spreaders for Sand, Salt, Cinders and Chips

345. Complete information on spreaders is available in literature issued by Anderson Engineering Co., 229 Bent St., Cambridge 41, Mass. Models, performance features, mounting operations, maintenance costs and other details are included. Check the coupon.

11-55

USE THIS COUPON to get detailed information on products and materials mentioned in this issue. Circle numbers below and mail today.

STOP READ AND SEND

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239 240 242 247 250 257 275 277 278 281
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310 316 319 324 325 330 331 334 337 339
340 341 342 343 344 345 346 348 353 356
359 362 366 374 375 376 380 385 389 396
398 399 405 406 409 410 413 418 420 421
422 438 439 440 441

New Products, pages 150 to 153

11-1 11-2 11-3 11-4 11-5 11-6 11-7
11-8 11-9 11-10 11-11 11-12 11-13 11-14
11-15 11-16 11-17 11-18 11-19 11-20 11-21

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NOT GOOD AFTER DEC. 15, 1955 MAIL THIS CARD NOW

To order these helpful booklets check the coupon on page 32

SEE THE "INSIDE" STORY OF THE SUBMERSIBLE

BJ

This new Byron Jackson film shows you the basic principles and operation of the Submersible pump in a technically accurate and extremely entertaining full-color movie.

Here in an 18-minute full-color sound film—"The Submersible Story"—is a factual account of the modern pumping unit that operates with both motor and pump underground—out of sight and out of sound. History and development of the Submersible are covered from early designs to present day applications and installations. Extensive animation is used to illustrate operation and show the construction and working principles of key Submersible parts, including the mechanical and mercury seals.

Put This Film to Work for You

This film, with its fund of essential engineering information about the Submersible, has many uses. It gives operating and maintenance personnel an understanding of the operation and care of the Submersible. It gives engineering and technical people a better grasp of the basic engineering principles involved and an insight into the history and development of the Submersible. It gives non-technical people an entertaining, educational story of this modern pumping method which is playing an increasingly important part in supplying vital water supplies to towns and cities, industry and agriculture.

Byron Jackson—manufacturer of the BJ Submersible—extends an invitation to you to see this new film and to arrange showings for interested groups and organizations. There's no obligation. Write Roger Barron, Submersible Products Manager, Byron Jackson Pumps, P.O. Box 2017, Terminal Annex, Los Angeles 54, California.

FILM HIGHLIGHTS:

- The First Submersible Motor
- Oil Lubrication versus Water Lubrication
- Principle of Mercury Seal and Mechanical Seal
- Installation of the Submersible
- The Submersible's Many Uses
- Two Approaches to Municipal Pumping Needs

BJ

Byron Jackson
Division of Borg-Warner Corporation

P. O. Box 2017, Terminal Annex
Los Angeles 54, California

Now's the time to mail this month's Readers' Service Card.

NEW LISTINGS (Cont.)

Facts about Sign-Hanging

302. A bulletin describing and illustrating street sign hanging tools, equipment and kits that make sign-hanging a quick and economical job is now available from A. J. Gerrard & Co., Melrose Park, Ill. The bulletin illustrates the special supports for one or more signs, and for off-the-street hanging. Check the coupon.

Valuable Booklet on Taste and Odor Control in Water Purification

334. An 80-page booklet "Taste and Odor Control in Water Purification" covers the history of taste and odor control, sources of bad tastes and odors such as algae, determination of odor concentration, and means of control by water plant processes. Complete information is given for the use and methods of application of activated carbon including feeding, storage and handling. Write to Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. or check the coupon for your copy.

Information on Reinforced Concrete Pavements Without Joints

348. A 66-page catalog that is a survey and correlation report on reinforced concrete pavements without joints has just been released by Rail Steel Bar Association, Chicago, Illinois. Concrete pavement behavior and trends as to deficiencies, pumping treatment, control of pumping, designed joints, granular subbases and other valuable information is included. Check the coupon today.

Twenty Different Attachments For the Multi-Purpose Gradall

374. A new illustrated booklet has just been issued by Warner & Swasey Co., Gradall Division, Cleveland 3, Ohio, showing the many different attachments, which greatly extends the usefulness of the Gradall as an earth-moving and materials-handling machine. On the job illustrations are included. Check the coupon today.

Install Water Lines to Last Longer

325. "Transite Pressure Pipe and the Ring-Tite Coupling" is an illustrated 8-page booklet that shows manufacturing methods in producing asbestos-cement pipe for water systems and describes savings in installation time and gives recommended procedures for installing the pipe and assembling the Ring-Tite Coupling. For full details write Johns-Manville, 22 East 40th St., New York 16, N. Y., or check the coupon.

Safe-T-Cones Solve Traffic Problems Night and Day

136. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nightime use—get bulletin from Radiator Specialty Co., Charlotte, N. C. Information included on Safe-T-Signs which add greatly to value of markers. Check the coupon now!

How to Skidproof Icy Streets

185. Specific facts on how to fight ice in winter are presented in the leaflet "Melt or Skidproof Ice Surfaces with Wyandotte Calcium Chloride". Write Wyandotte Chemicals Corp., Wyandotte, Mich. or check the coupon.

End Dangerous Ice Hazards

294. Many progressive municipalities use rock salt as standard practice for prevention of ice hazards on streets and highways. Get full data on Sterling "Auger-Action" Rock Salt and suggestions on storage methods from International Salt Co., Scranton, Pa. Check the coupon today.

Small Tractor Has Countless Uses

308. The "Agricat" tractor provides a small, powerful unit that can be used on lots of jobs. Tight spots are no obstacle. Attachments for dozing, snow plowing, loading. Full data available from Earl H. Pence & Co., Inc., 2150 Washington Ave., San Leandro, Calif. Check the coupon today.

Attachments Keep Snow-Thrower On Job the Year 'Round

319. A variety of attachments designed to fit the rugged tractor unit of the Maxim Snow Thrower make it an all-year worker ready for mowing, cutting, dozing, towing and rolling. Full details on these economical snow throwers and their useful attachments are covered in bulletins offered by Maxim Silencer Co., 85 Homestead Ave., Hartford, Conn. Check the coupon for this data.

For Prompt Service Use The Coupon

New Spin-Zit Salt Spreader

339. A bulletin has just been released on a new salt spreader by the Spin-Zit Salt Spreader Company, P. O. Box 829, New Bedford, Massachusetts. This spreader can be rigged in one minute, weighs 70 lbs., has electric motor powered from truck battery, and has automatic bag opener and screen to name a few of the features. Check the coupon today.

Information on Two New Allis-Chalmers Tractors

340. For full details on more performance, versatility and dependability in a 45-drawbar-hp tractor get the new bulletin on Allis-Chalmers' two new HD-6 series tractors. Included is information on extra clutch life—with ceramic lining, power, strength and protection, new design and other features. Send to Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin, or check the coupon.

Valuable Bulletin on Rodney Hunt Sluice Gate

353. Sluice gate seats on a resilient rubber seal flush with the bottom of the channel and eliminates bottom wedges and the trough in which they descend. Gives design flexibility in water filtration, sewage treatment and sluices, dam, channel and chamber flow control. For complete details write to Rodney Hunt Machine Co., 82 Lake Street, Orange, Mass. for Bulletin 75, or check the coupon.

SINCE 1951...

SOUTHERN CALIFORNIA GAS COMPANY

Detectron

"505" PIPE DETECTORS -- have been used by Southern Calif. Gas Company

Serving 4,800,000 persons with more than 13,787 miles of main lines.

more than 200 now in use performing ALL these jobs!

• Detect, trace and center pipes, cables, etc.

• Estimate their depth

• Separate parallel pipes, cables, etc.

Maximum efficiency in every operation is the key to the low consumer rates offered by this leading utilities company. Damage or breakage of existing pipeline during street excavation was a costly, time consuming problem — solved by equipping all service and repair trucks with a modern electronic pipe detector.

WRITE FOR COMPLETE "Utilities Instruments" CATALOG

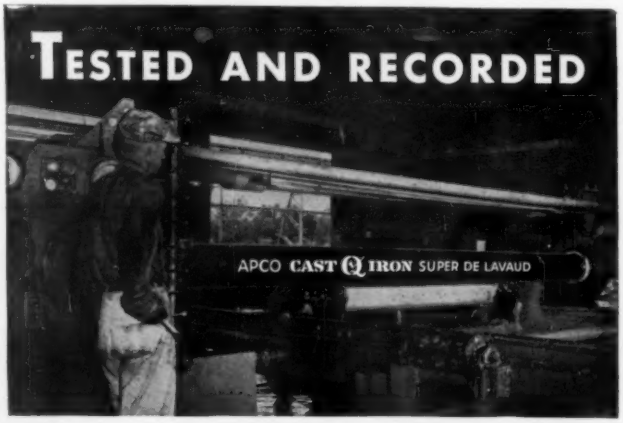
Detectron

COMPUTER-MEASUREMENTS CORP.

Utilities Instrument Divison

5457 Cleon Avenue, Dept. 55, North Hollywood, California

TESTED AND RECORDED



Each length of pipe we manufacture passes through the above hydrostatic test press where it is filled with water and the pressure raised to 500 pounds per square inch. The most common water works pipe is designed for an operating pressure of 150 pounds per square inch. This undergoes the 500 pounds per square inch hydrostatic test and permanent records for each piece of pipe are kept on file for inspection by our customers at all times. You can be assured with Alabama's Super De Lavaud Cast Iron Pipe. In sizes of 3" to 24" in modern long lengths. Bell and Spigot, Mechanical Joint and Flanged Pipe.

General Sales Offices

ANNISTON, ALABAMA

We Invite Inquiries to Our Nearest Sales Office

120 S. Michigan Ave. Chicago, Illinois

250 Fifth Avenue New York 1, New York

ALABAMA PIPE COMPANY

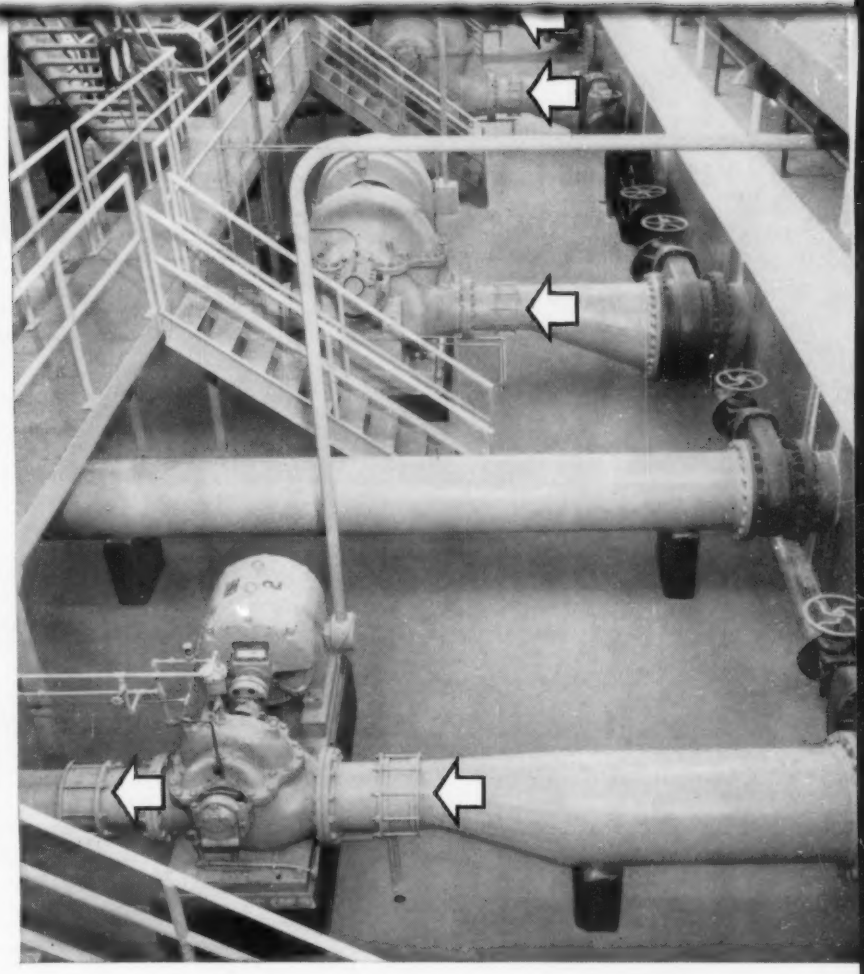
ANNISTON ALABAMA

Get full details of this month's products . . . mail your Readers' Service card today.

Now's the time to mail this month's readers' service card.

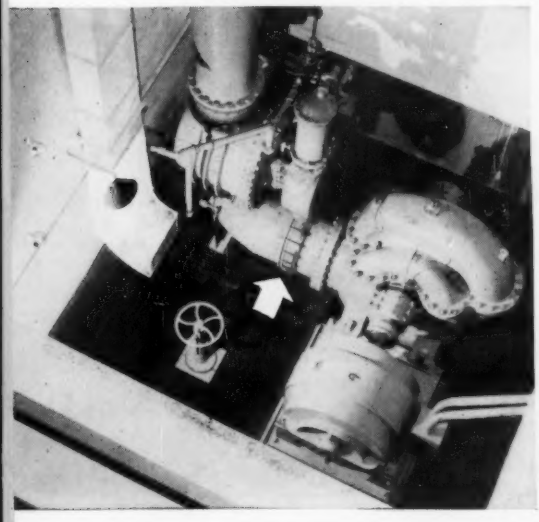
SPEAKING OF PUMP PIPING

The Elm Fork Water Plan: Pumping Station of Dallas, Texas, doubles the city's purified water supply with its capacity of 105 mgd at 150 psi. Dresser Style 38 Couplings were installed on suction and discharge lines connecting high lift station pumps (right) and on discharge side of low lift pump (below) . . . to take care of movement or misalignment, and to make installation and disassembly easy. Consulting engineering was by Myers and Noyes and Associates; the contractor was E. E. Farrow Company.



DOUBLE DUTY FOR DALLAS

DRESSER COUPLINGS PROVE IDEAL FOR PUMP CONNECTIONS



Having spent eight million dollars for this superb new water facility, the city of Dallas protects its investment with Dresser-Coupled pump connections.

Thus, each line is provided with *built-in* flexibility. The resilient wedge-shaped gaskets in every Dresser Coupling absorb and cushion vibration and pipe-transmitted stresses.

Moreover, the unique Dresser design assures fast, foolproof installation. There's no need for exact pipe fitting or aligning operations. Joints are sealed bottle-tight for life . . . with a wrench, the only tool required. Any workman can make 100% tight joints and maintenance is simplified by easy teardown.

Give all your water piping jobs the same advantages. Specify Dresser Couplings—the proved, low-cost, trouble-free way to make pump connections . . . and for every other type of piping installation.

See your piping supplier today on how you can save on water and sewerage projects.

DRESSER®

ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales offices also in: New York, Philadelphia, Chicago, Denver. In Canada: Toronto and Calgary.

To order these helpful booklets check the coupon on page 32.

CONSTRUCTION EQUIPMENT AND MATERIALS

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the coupon. Sherman Products, Inc., Royal Oak, Mich.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the coupon today.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, is available from Reed Mfg. Co., Erie, Pa. Check the coupon.

Drill Concrete With Your Ordinary Electric Drill

376. Substantial cost-per-hole savings are shown with Tilden Rotary Konkrete Kore Drills, which penerate reinforced concrete up to 6" per minute. Standard drills available in sizes 3/16" to 6". Larger sizes on order. Free sharpening service continued. Full data from Tilden Tool Mfg. Company, 209 Los Molinos, San Clemente, California, or check the coupon.

Safety Lantern With Pencil Beam Signal

70. Get information on the Dietz "Night Watch" Safety Lantern with special globe design that saves fuel by intensifying light rays into a pencil beam. Full details available from R. E. Dietz Co., Syracuse, N. Y. Just check the coupon for full data.

Examine a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-2 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the coupon.

Complete Protection Of Iron and Steel Products

242. What are the advantages of Hot-Dip Galvanizing? Why does it offer complete protection at such an economical cost? You'll find the answers in the attractive booklet "Stop Rust", which gives you the full story of the process plus a comprehensive coating comparison chart. Get your copy promptly by checking the coupon or write American Hot-Dip Galvanizers Assn., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. Get full details by checking the coupon. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

How Motor Graders Beat the Snow Problem

307. The power and directional control of Austin-Western Four-Wheel Drive, Four-Wheel Steer Power Graders are a combination that beats the toughest plowing combination. Get data on plow and snow loader attachments for graders from Austin-Western Co., Aurora, Ill. Check the coupon.

A Helpful Booklet For Those Who Build and Maintain Roads

310. "Governmental Graders," a booklet published especially for the 18,000 governmental agencies with jurisdiction over local rural roads tells how the three sizes of "Cat" motor graders do the job on road building and maintenance programs. Of particular interest is a table of repair costs compiled from public records. Get your copy from the Caterpillar Tractor Co., Peoria 8, Ill., or by checking the coupon.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Full data on these ditchers available by checking the coupon.

Owners report the new Frink One-Way Taper Blade Sno-Plow used again in last winter's severest storms proved itself to be the most rugged and efficient one-way ever made. Operators particularly praised the throwing and spreading qualities of the Frink because it does not form high side banks that encourage drifting.

The increased taper and moldboard curvature permit higher speeds because of the increased visability and ease of handling.

Frink One-Way Sno-Plows are available in 3 sizes and are interchangeable with the Frink V-Type, Reversible Type, or Roll-Over Type Sno-Plows and the Frink Roto-Broom.

FRINK SNO-PLOWS

For further information on this Sno-Plow write for catalog to Clayton, N. Y., Box PW5511

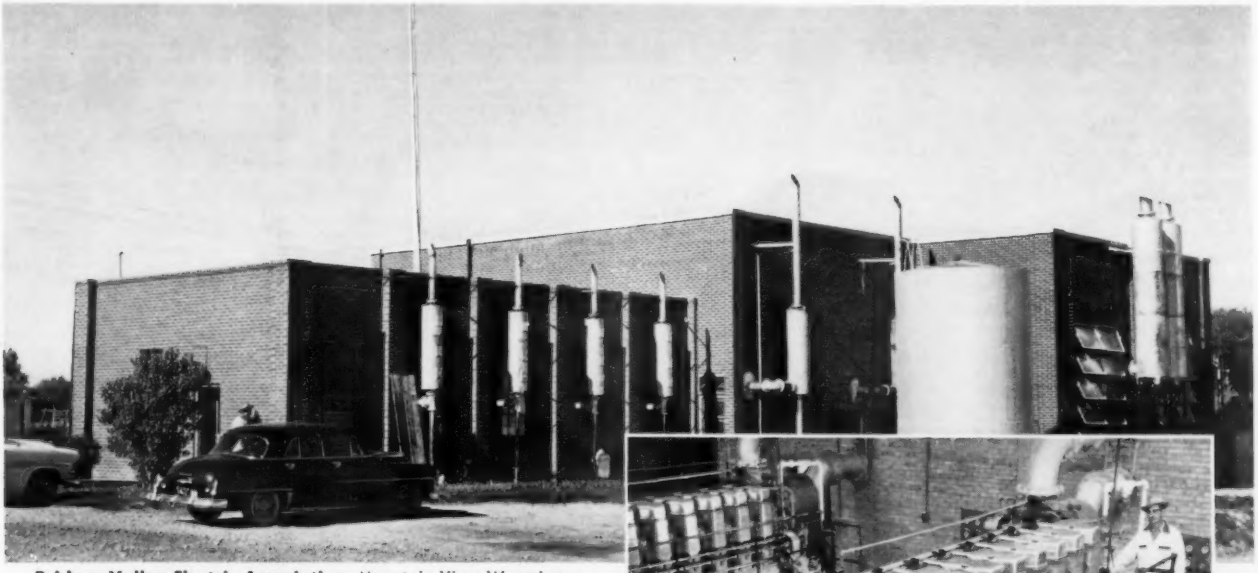
FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK

Made in Canada by

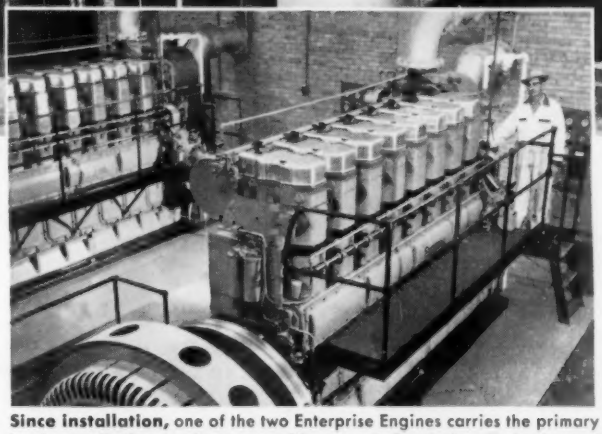
FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

Need more facts about advertised products? Mail your Readers' Service card now.

3 Times the Lube Oil Economy with Enterprise Engines at Lyman, Wyoming



Bridger Valley Electric Association, Mountain View, Wyoming, operates this well-designed diesel power plant at nearby Lyman. Last two units were installed in 1952—both Enterprise DGSG-38 Dual Fuel Engines, rated 925 HP at 450 RPM.



Since installation, one of the two Enterprise Engines carries the primary load at all times, alternates with second Enterprise Turbocharged 8-Cylinder unit. Older plant engines are cut in as required during peak load periods. John Brinton is the operator.

23,597 BHP hours per gallon for entire REA Electric plant*
38,074 BHP hours for the Enterprise Dual Fuel Engines

—more than 3 times the lube oil economy reported by the next best plant!

This record of low lube oil consumption is nothing short of phenomenal. These are the facts from plant records and U.S. Government reports comparing the operating records of 30 REA plants.* It shows that the Lyman, Wyoming, electric co-op ranks first by far in lube oil economy. In every other comparison, too, the Bridger Valley Electric Association plant has established an enviable position through outstanding performance and efficient operation. Since the two Enterprise Dual Fuel Engines were added in 1952, they have virtually replaced the original plant units, which are now used only for peak load and standby service.

If your city or co-op is considering new power in its plan to modernize or expand, it will pay you to plan with Enterprise. Here is dependable, record-proven equipment in the field of heavy-duty diesel, dual fuel, tri-fuel and spark ignited gas engines, 73 to 7703 HP. Write us today for full information, or call your nearest Enterprise office.

Under capable management of William E. Riding, co-op has thrived. Enterprise Engine dependability is proved again: not one enforced shutdown in nearly 30,000 hours of combined operation!

Plant Superintendent Kyle Peterson says: *"Our record of low lube oil consumption is just one of the things we like about Enterprise. They're really fine engines by any comparison, give us everything we expect—and more!"*

*From U. S. Department of Agriculture, Rural Electrification Administration: "Operating Data of Certain REA-Financed Internal Combustion Generating Plants—January 1 to March 31, 1955."

Over a million horsepower at work the world over!

ENTERPRISE
dependable **ENGINES**

ENTERPRISE ENGINE & MACHINERY CO.
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Minneapolis • New Orleans • New York • Pittsburgh • San Diego • Seattle • St. Louis • Tulsa • Washington, D.C.

Now's the time to mail this month's Readers' Service Card.

To order these helpful booklets check the coupon on page 32.

Power Hydraulic Control Equipment

396. Literature on the installation and performance of Monarch power hydraulic control equipment is available from Monarch Road Machinery Co., Hydraulic Division, Grand Rapids 4, Michigan. Explained fully are the applications of the Monarch controls on road machinery , snow plows, truck and tractor-mounted accessories. Check the coupon.

Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal, and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the coupon.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co., Winona, Minn. Also, information on front-end loaders and other attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the coupon.

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago, Ill., by using coupon.

REFUSE COLLECTION AND DISPOSAL

Engineering Data on Incinerator Design

118. A comprehensive bulletin which provides full engineering data on municipal refuse incineration is offered by Pittsburgh-Des Moines Steel Co., 3422 Neville Island, Pittsburgh, Pa. This 20-page booklet shows basic requirements for satisfactory incineration, gives incinerator design details and describes modern mechanical stoking, construction features and modernization of existing plants. Get your copy by checking the coupon.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy coupon or write Combustion Engineering Inc., Raymond Div., 200 Madison Ave., New York 16, N. Y.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 8, Wis. Get your copy by checking the coupon; you'll find this booklet both interesting and valuable.

What You Should Know About Refuse Incinerators

362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the coupon.

STREETS AND HIGHWAYS

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the coupon for your copy of this helpful reference bulletin.

Levels Sidewalks and Curbs Quickly and Easily

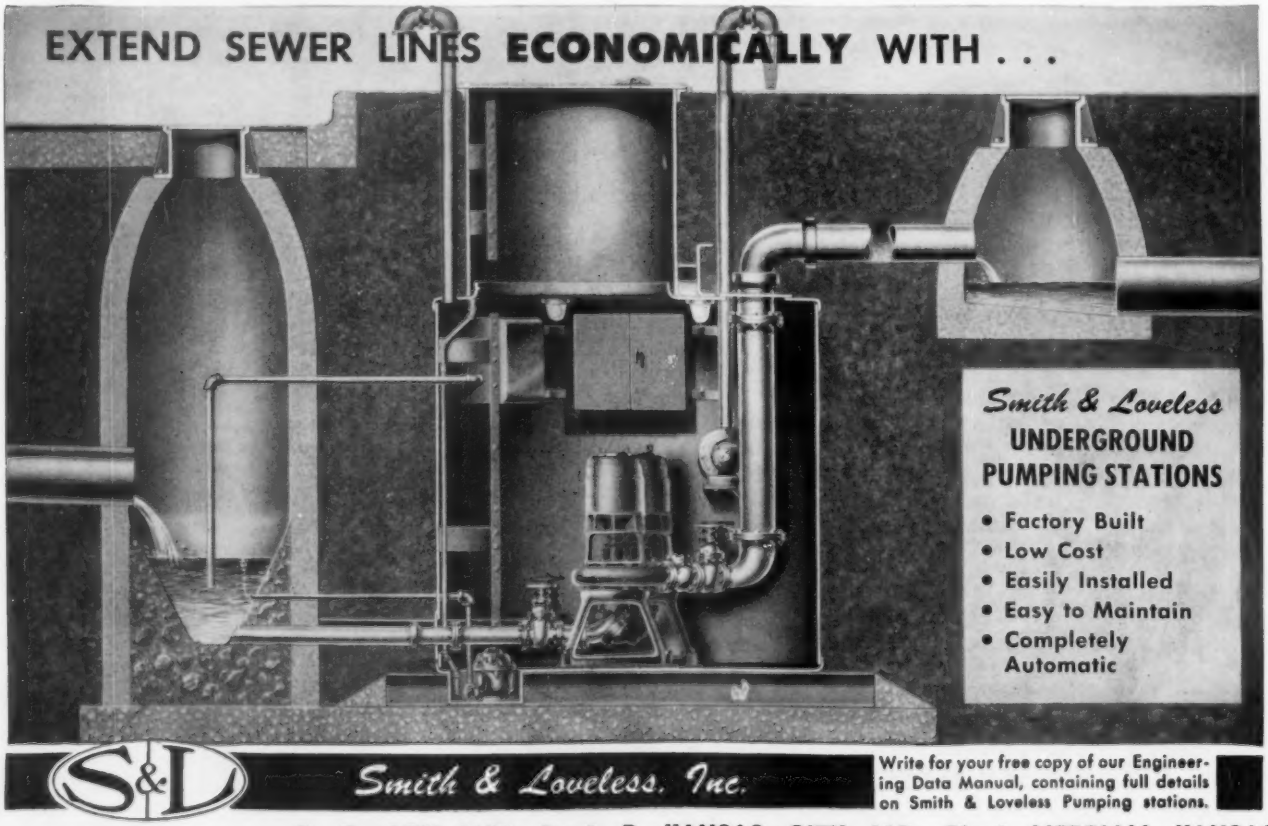
29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

How to Get Better Grader Operation

111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the coupon for your copy.

Makes Underground Pipe Installation Easy

115. One-man operated hydraulic pipe pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts ask for Form E-213, Greenlee Tool Co., Rockford, Ill. Just check the coupon.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Smith & Loveless
UNDERGROUND PUMPING STATIONS
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• Low Cost
• Easily Installed
• Easy to Maintain
• Completely Automatic
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Smith & Loveless, Inc.
Write for your free copy of our Engineering Data Manual, containing full details on Smith & Loveless Pumping stations.

P. O. BOX 8172, Dept. P, KANSAS CITY, MO., Plant, MERRIAM, KANSAS

Need more facts about advertised products? Mail your Readers' Service card now.

Now's the time to mail this month's Readers' Service Card.

SURGEABILITY...

THE LATEST WORD IN WATER TREATMENT

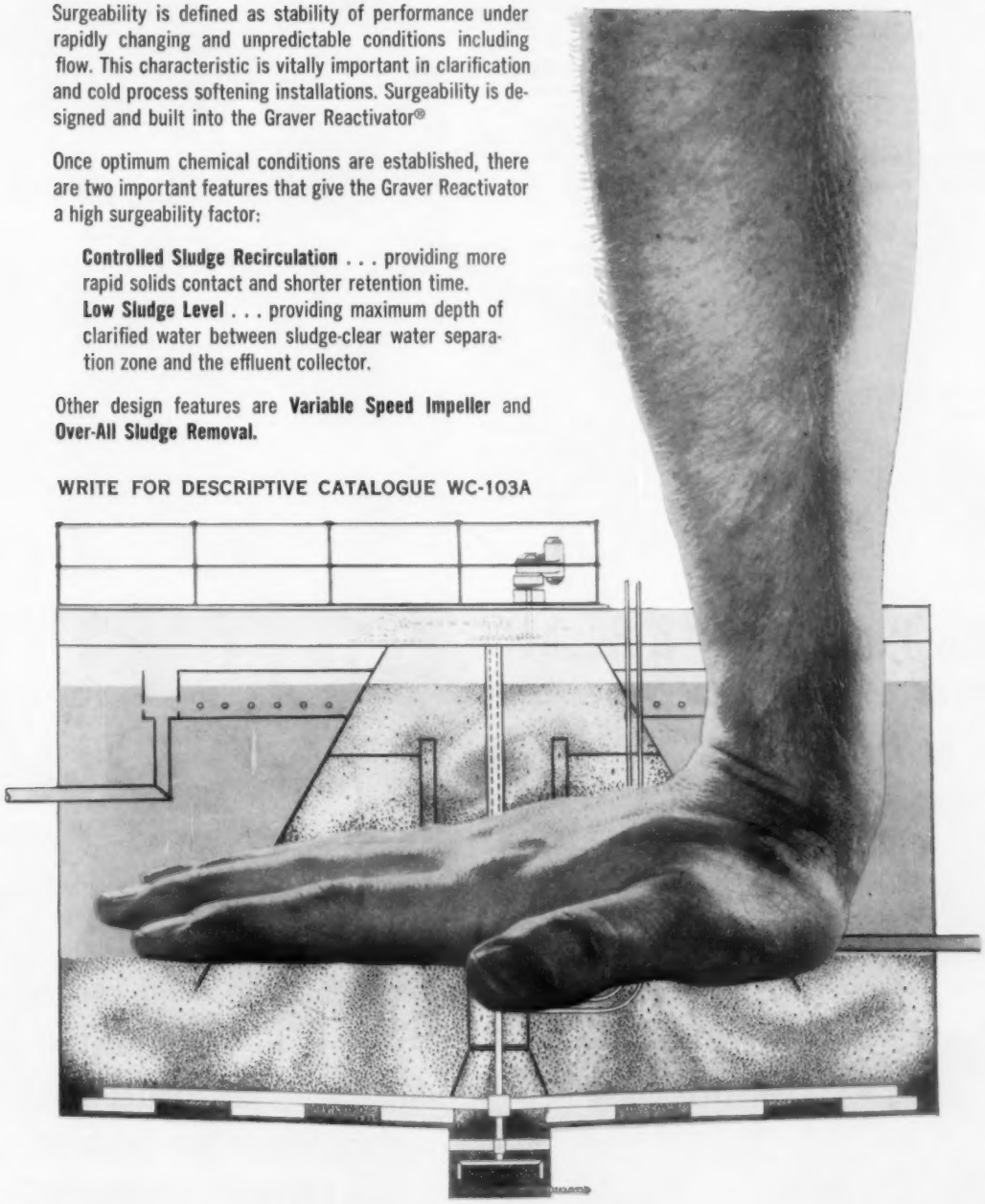
Surgeability is defined as stability of performance under rapidly changing and unpredictable conditions including flow. This characteristic is vitally important in clarification and cold process softening installations. Surgeability is designed and built into the Graver Reactivator®

Once optimum chemical conditions are established, there are two important features that give the Graver Reactivator a high surgeability factor:

Controlled Sludge Recirculation . . . providing more rapid solids contact and shorter retention time.
Low Sludge Level . . . providing maximum depth of clarified water between sludge-clear water separation zone and the effluent collector.

Other design features are **Variable Speed Impeller** and **Over-All Sludge Removal.**

WRITE FOR DESCRIPTIVE CATALOGUE WC-103A



Department NK

GRAVER

GRAVER WATER CONDITIONING CO.
A Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

Get full details of this month's products . . . mail your Readers' Service card today.

Self-Propelled Sidewalk Paver Lays Up to 10 Ft. per Minute

117. Bulletin 52, released by Dotmar Industries, Inc., Kalamazoo, Mich., describes the Dotmar paver, which can lay up to 10 ft. per minute of walk when working with transit mix units. Paver is readily convertible to pave curb and gutter, or integral curb, gutter and walk. Get the 8-page illustrated bulletin for full data and reports from users. Just check the handy coupon.

How the "Payloader" Helps Public Officials

190. An attractive new booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities. You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the coupon or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the coupon or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the coupon.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

Choosing Trucks For Municipal Service

204. Trucks that are high in efficiency and economy are needed for all municipal services. Be sure to investigate latest models of White motor trucks, engineered for high performance under all conditions. Full details from White Motor Co., Cleveland 1, Ohio. Check the coupon today.

Windrow Loader is Tailor Made for Majority of Highway Needs

296. The peculiar problems of windrow loading require in most cases a medium capacity, low cost, highly maneuverable machine. To meet these needs Barber-Greene Co. now has a 4 cu. yd. per min. Windrow Loader, mounted on a John Deere wheel tractor. Further details may be obtained from Barber-Greene Co., Aurora, Ill., by checking the coupon.

How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to the Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Effective Sweeping for Cleaner Streets

421. Outstanding features of Wayne Model 450 Sweepers are described in an attractive folder which covers operating advantages and general specifications. Data on dual control models are included. For your copy write Wayne Mfg. Co., Pomona, Calif., or check the coupon.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem, reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16-page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the coupon for your copy.

Advanced Tractor Design Gives Better Performance

399. For greater power, performance and economy, Ford Tractor offers 4-wheel stability, built-in hydraulic system and power take-off among the many new features. A complete booklet describes five models in two power series, showing the latest in advanced tractor design. For your copy check the coupon or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the coupon and we will forward your request.

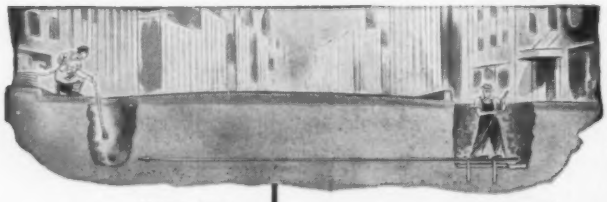
Packaged Sewage Treatment— Just Right for Small Places

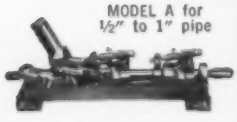
36. "Package" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., Dept. J, 622 Diversey Pkwy., Chicago 14, Ill.

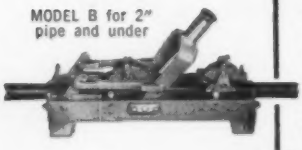
Trojan Pipe Puller & Pusher

installs or renews pipe under pavement

in half the time required by any other machine!







Exclusive continuous action, which eliminates all resetting of grip, does the trick!

The Trojan combines pushing and pulling operations in one machine—keeps pipe continuously moving—lets you install 40' services in as little as 20 min.

Model A needs only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B is reversible in 30 seconds—has 3 speeds for different soils. New dog with individual inserts cuts maintenance.

Write today for full details!

The TROJAN Manufacturing Co.

1114 Race Drive • Troy, Ohio

FILTER SAND AND GRAVEL

Produced from an inland pit hence free from river contamination and foreign matter.

Shipment in bulk or bagged.

Many of the larger filter plants throughout the United States are equipped with our products.

PROMPT SHIPMENT

Inquiries and orders solicited.

NORTHERN GRAVEL COMPANY

Muscatine, Iowa

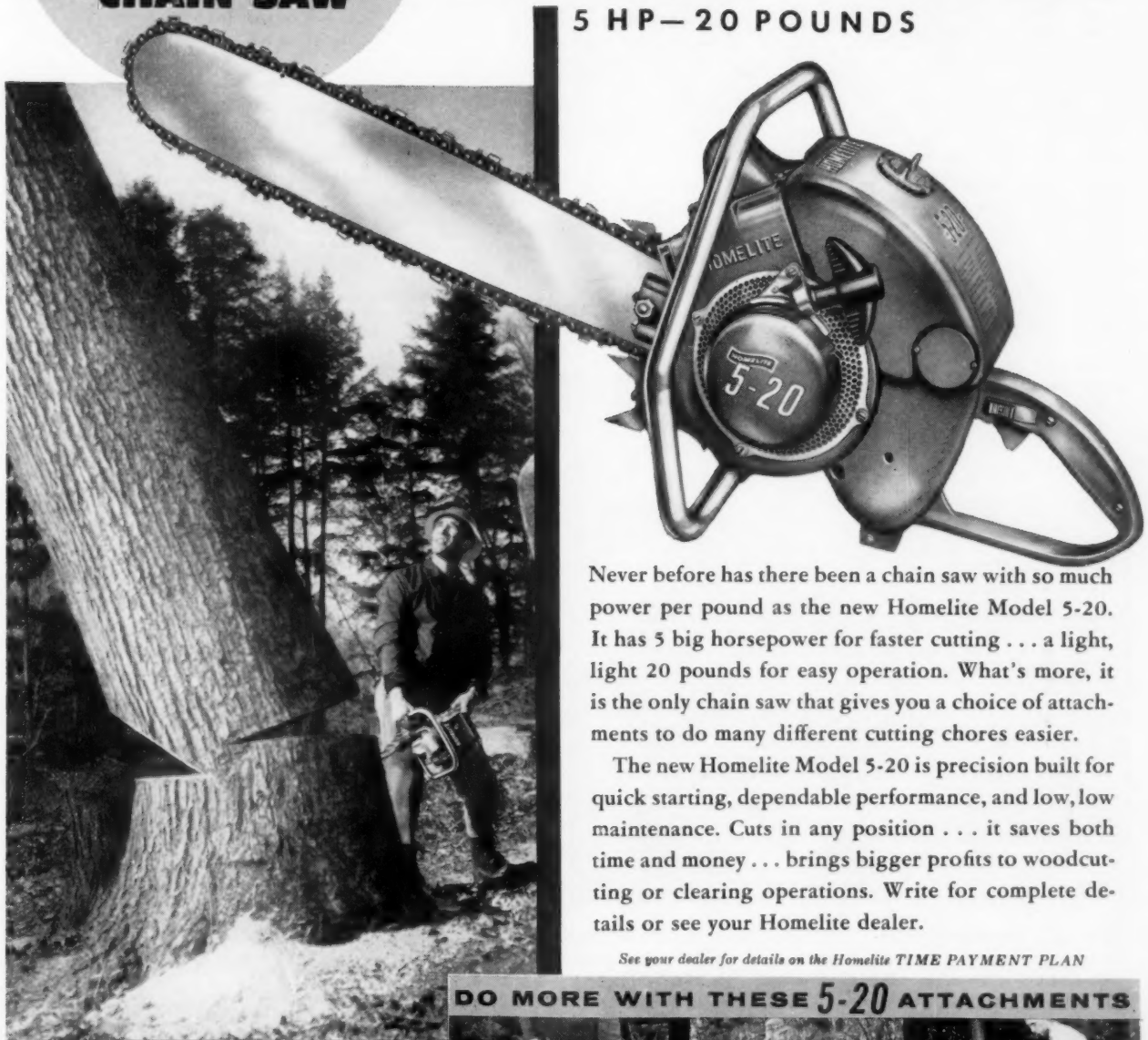
P.O. Box 307 Amherst 3-2711

Now's the time to mail this month's Readers' Service Card.

HOMELITE 5-20 CHAIN SAW

It's NEW... It's alive with power

5 HP—20 POUNDS



Never before has there been a chain saw with so much power per pound as the new Homelite Model 5-20. It has 5 big horsepower for faster cutting . . . a light, light 20 pounds for easy operation. What's more, it is the only chain saw that gives you a choice of attachments to do many different cutting chores easier.

The new Homelite Model 5-20 is precision built for quick starting, dependable performance, and low, low maintenance. Cuts in any position . . . it saves both time and money . . . brings bigger profits to woodcutting or clearing operations. Write for complete details or see your Homelite dealer.

See your dealer for details on the Homelite TIME PAYMENT PLAN

Packed with power, the new Homelite Model 5-20 Chain Saw brings down big trees six feet in diameter, cuts through 20" trees in 20 seconds without forcing or jamming. Anyone can operate it . . . no experience necessary.

DO MORE WITH THESE 5-20 ATTACHMENTS

Interchangeable Blades add versatility to the new Homelite 5-20 Chain Saw. For felling, bucking, limbing or plunge cutting, there's a hard track blade for every requirement. Straight blades available from 14" to 60", bow saws 14" and 18".

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How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement–tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

Complete Sanitation and Process Equipment Bulletin

40. A complete illustrated bulletin gives detailed information on all "Rex" sanitation and process equipment. 36 pages of engineering data, process descriptions, conversion factors. Get Bulletin 51-83 by checking the coupon. Chain Belt Co., Box 2022, Milwaukee 1, Wis.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible, Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

Helpful Installation Manual For Drainage Structures

62. A 46-page manual, well worth careful study by designers and field engineers dealing with drainage structures, culverts, sewers or conduits, is offered by Armco Drainage & Metal Products, Inc., Middletown, Ohio. Proper location of the structures, base preparation, assembly and backfill are some of the many items covered in detail. Use the handy coupon for free copy.

Theory and Application Of the Flow Tube

84. Hydraulic formulae, head capacity curves and test data for this primary metering element are given in a technical bulletin, "Theory and Application of the Flow Tube," available from Foster Engineering Co., Union, N. J. Check the coupon for a copy.

Engineering Data on Screening Equipment

77. Water, Sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Dept. 137, Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable, comprehensive booklet may be obtained by checking the coupon.

Mechanical Joint Principle Applied to Sewer Pipe

101. The Amvit joint forms a tight compression seal between bell and spigot rings, prevents infiltration and stops root intrusion. Get data on Amvit jointed vitrified clay pipe from American Vitrified Products Co., Cleveland, Ohio.

Proper Installation of Bituminized Fibre Sewer Pipe

105. A well-planned instruction leaflet showing the proper step-by-step procedure for installation of Bermico bituminized fibre sewer pipe has been made available by Brown Co., 150 Causeway St., Boston 14, Mass. To make sure of best results in pipe installation, just check the coupon for your copy.

What You Should Know About Design and Use of Concrete Sewers

122. Every engineer and contractor should have a copy of the 48-page book "Concrete Sewers" in his library. This valuable text, published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 33, Ill., gives an authoritative discussion of hydraulics, sewer design, construction and maintenance. Generous use of helpful illustrations makes the book attractive and helpful to the reader. For your copy, just check the handy coupon.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the coupon or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

Standardized Process Control Instrument

203. Meters, regulators, indicators and pneumatic recorders and controllers are described in a 24-page catalog available from the Fischer & Porter Company, Hatboro, Penna. Complete specifications including dimensions, prices, capacities and construction materials are included. Check the coupon for your copy.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

Submersible Sewage Ejector Simplifies Installation

275. The Weil submersible non-clog sewage ejector is a compact unit with a completely sealed motor, available in several sizes with capacities up to 300 gpm. For details on unit selection, installation methods, construction features and controls get Bulletin SE-860A from Weil Pump Co., 1530 No. Fremont St., Chicago 22, Ill. Check the coupon.

Shredders and Grinders For Efficient Sewage Treatment

346. Latest data on screenings shredder, garbage grinder and dry sludge shredder are presented in Bulletin SG10 by Gruendler Crusher & Pulverizer Co., 2915 North Market St., St. Louis 6, Mo. Dimension and capacity charts are provided, together with drawings and photographs of the grinders and screens. Check to coupon.

Engineering Data on The Spiraflo Clarifier

366. Helpful engineering data on the Spiraflo clarifier are presented in 8-page Bulletin 6791 by Yeomans Brothers Co., 1999 N. Ruby St., Melrose Park, Ill. Details on operation of the unit, performance data, typical plan and elevation, detention time curve and mechanical specifications are included in this useful publication. To get your copy just check the coupon.

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Big snows paralyze cities and businesses. The Barber-Greene Snow Loader removes snow at a clip of 7-11 yards per minute. A swivel conveyor keeps trucks moving in a continuous production line. Only one traffic lane is required. At a 15 m.p.h. road speed, the B-G Snow Loader moves from one location to another quickly.

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After the snow season, the B-G Snow Loader, a year 'round machine, handles coal, leaves and other nonabrasives. Also, it can be converted into a Bucket Loader to handle aggregate materials.

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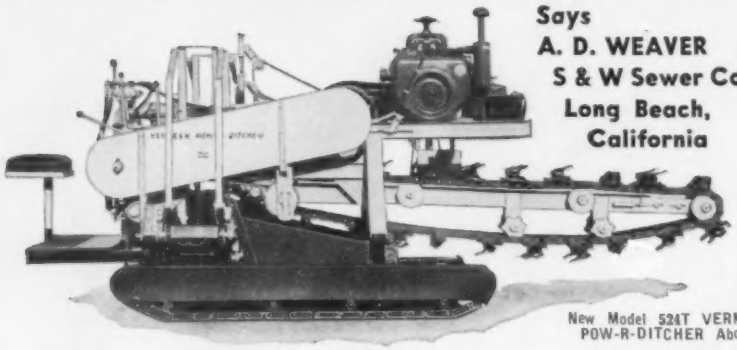

New Model 524T VERMEER POW-R-DITCHER Above.

BIG DITCHER PERFORMANCE AT LESS THAN HALF COST!

Here's the heavier, stronger, more rugged ditcher that digs for less . . . because it costs so much less! The Vermeer Model 524T POW-R-DITCHER is ideal for contractors, municipalities, utility companies, etc. Digs 8", 10", 14", 18" and 24" wide and down to 6 feet deep. Has 5-speed International Truck Transmission, hydraulically engaged steering controls. This self-propelled, one man operated ditcher is designed to handle wide foundation footings, gas, water and sewage lines at speeds of 1' to 15' per minute. Weighs 5,400 lbs. Get the facts now on this **low priced ditcher** that does the work of more expensive ditchers and trenchers . . . **at a fraction of the cost!** SmallerVermeer Pow-R-Ditcher models also available. Write for name of distributor and complete details.
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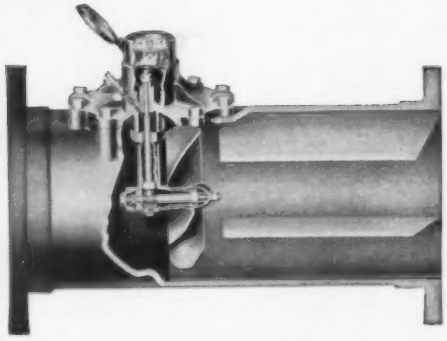

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STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn

Street Lighting Application Curve Eliminates Calculations

257. An easy-to-use chart from which illumination level, spacing and proper mounting height can be determined has been prepared by the Illuminating Engineering Laboratory, General Electric Co., West Lynn 3, Mass. For a copy of the chart and instructions on its use check the handy coupon.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems. Check the coupon for your copy of this helpful guide.

How to Save on the Cost of Signs

405. Sign costs have been reduced significantly by many cities, counties and states that switched to Alcoa aluminum for signs and markers. Strength and corrosion resistance cut maintenance costs; aluminum fasteners mean trouble-free installation. For full material specifications write Aluminum Company of America, 1978-D Alcoa Bldg., Pittsburgh 19, Pa., or check the coupon.

Comprehensive Bulletin Covers All Sign Needs

406. Data on warning and regulatory signs, street name signs, devices, posts and reflector buttons are furnished in comprehensive Catalog 54 of the Cataphote Corp., Toledo 10, Ohio. You'll find information on all your sign needs, including button, sheeting and beaded reflectorization in this helpful booklet. Get your copy by checking the coupon.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on this spreader and table of material application rates. Use coupon or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, Thousand Islands, New York, or check the handy coupon for the catalogues.

Ice Control Without Corrosion Dangers

439. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. Check coupon for your copies.

Nothing like "STOP-AND-GO" maneuverability of WHITE 3000

No—nothing like the White 3000 turning radius, wide tread front axle and short wheelbase in municipal service.

It saves time in congested areas, heavy traffic, in narrow alleys.

And the White 3000 is engineered to exact operating conditions for bigger packer bodies, longer routes, more work.

For really modern garbage and refuse collection, go White 3000!

NEW EFFICIENCY FOR PACKER UNITS

CLAIRTON, Pa. has this modern White 3000 on the go to provide residents with the best in service. New "stop-and-go" efficiency in narrow alleys, crowded quarters. Shorter overall length also saves garaging space.

Wheelbase is 127½ inches, 10.00 x 20 tires, 507B transmission with 7.17 ratio, 89C rear axle.

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RUBBISH removal at Food Fair Stores, Philadelphia, Pa., is faster, more efficient with this new White 3000. Excellent maneuverability in close quarters in store areas to back into tanks and load . . . reports Schiavo Brothers.

White 3026 has White Mustang engine, 89C rear axle, 7.17 gear ratio, 507B transmission.

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69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

96 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, colorimeters and similar devices. A 96 page booklet. W. A. Taylor Co., 7304 York Road, Baltimore 4, Md.

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the coupon and you will receive detailed information on a complete line of water works equipment.

with **CLOW** *mechanical joint*

SPLIT SLEEVES

Don't be caught short this winter without a stock of Mechanical Joint Split Sleeves. Be prepared with sleeves for every size pipe in your system. Clow split sleeves fit all classes of cast iron pipe, and make a fast, simple, permanent repair.

F-1200 Straight Split Sleeves will repair breaks in the barrel of the pipe. F-1205 Bell Split Sleeves will repair damaged joints of underground pipe, as well as the barrel.

Clow Split Sleeves are shipped complete with joint accessories. All sizes 3" through 16" available for immediate shipment.

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Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., Box 3277, Los Angeles 54, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the coupon for your copy, or write for Bulletin 314.

Electric Power Wherever You Need It

75. Electric power for every job—for construction, maintenance and emergencies—is always available for the owner of a convenient Homelite carryable generator. These compact, gasoline engine operated units are made in a variety of sizes to suit every power requirement. Get full details by writing Homelite Corp., Port Chester, N. Y., or check the coupon.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast from pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves. Check the coupon for this useful information.

A Clamp That Fits Pipe Regardless of Irregularities

78. A clamp that can be used on either asbestos-cement or cast-iron pipe is described fully in a four-page bulletin just released by the Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. Complete instructions are given as to how the clamp is put on the pipe, along with a price list of the length and size of clamp desired. Just check the coupon.

What You Should Know About Pipe Detectors

94. A new, up-to-date operating manual for pipe detecting instruments has been made available by the Detectron Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make pipe detector. To get a copy just check the coupon.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves are contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., Eliot Street, Fairfield Conn.

How to End Hard Water Troubles

106. Permutit water softeners are described in a well illustrated, 20-page booklet which describes the principle of operation, design features, advantages and specifications of zeolite (cation exchange) water softeners. Both automatic and manually-controlled units are described. To get a copy of this helpful publication, Bulletin 2386A, write The Permutit Co., 330 West 42nd St., New York 36, N. Y., or check the coupon.

Vertical Turbine Pumps For Municipal Water Supply

121. Engineering data on vertical turbine pumps for deep or shallow well operation in capacities ranging from 50 to 10,000 gallons per minute, oil or water lubricated, are covered in a booklet issued by Worthington Corp., Vertical Turbine Division, Succasunna, N. J. Check the coupon today for this helpful information.

Equipment for Waste and Water Conditioning Processes

240. Equipment for conditioning of municipal and industrial water and treatment of industrial wastes is discussed in Bulletin WC-117, issued by Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. For your copy check the coupon or write direct to the manufacturer.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the coupon.

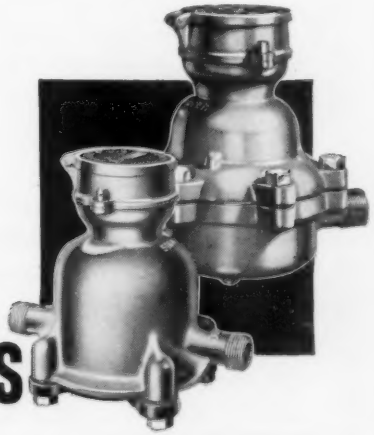
Water is vital...

Badger meters conserve it better!

THE malting industry uses nearly *3-billion gallons* of water per year to produce this taste-inviting ingredient for America's favorite beverages and foods. Actually, 35 times *more water than barley* is involved in the processing.

Badger water meters are a vital part of most large-volume processes—helping conserve water for America's growing industrial and residential needs. Accurate measurement provides a precise check on usage and waste . . . makes certain that users pay fairly for water consumed . . . helps make water departments self-supporting.

Waterworks men everywhere recognize the superior performance of Badger water meters. Your Badger Meter representative can help your community save water, work and money. Write:



Badger Water Meters

Badger Meter Mfg. Co.
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"Measuring the water of the world for 50 years"

Helpful Data on Sluice Gates

286. In a well-organized 170-page catalog you will find complete engineering and design data on Pekrul sluice gates, headgates, automatic flap gates, lifts and accessories. Pertinent data on models and sizes for virtually every application will be found in this publication. This catalog, PK 55, can be had by applicant writing on business letterhead to Pekrul Gate Div., Morse Bros. Machinery Co., Denver 1, Colo.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wis. Check the coupon for your copy.

Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 140 from Norton Co., Worcester 6, Mass. by checking the coupon.

Reference Data on the Electric Check Valve

344. Comprehensive data on the new Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the coupon for Bulletin W-10.

Verti-Line Primary Water Supply Pumps

110. Vertical turbine pumps for industrial and municipal primary water supply are described in an 8-page bulletin No. 100. Sectional illustrations with enlarged views of special features of the products and detailed drawings of pumping and distribution systems are included. For more information write Layne & Bowler Pump Co., 2943 Vail Avenue, Los Angeles 22, California, or check the coupon.

Reference Catalog for Valves, Fittings and Hydrants

125. Complete data on gate valves for all services, operating accessories, check valves, fire hydrants and related specialties plus a reference section of useful engineering data is contrained in Catalog H-1 issued by Rensselaer Valve Co., Troy, N. Y. All engineers who specify valves, fittings, and hydrants should have this valuable catalog for ready reference. Check the coupon.

Specifications for Infiltration Galleries

159. Infiltration galleries, constructed by the Ranney method, are described in an attractive bulletin issued by Ranney Method Water Supplies, Inc., 841 Alton Ave., Columbus 19, Ohio. This bulletin, plus complete standard specifications for the construction of horizontal infiltration galleries, are available by checking the coupon.

Locate Mains, Services and Leaks Without Digging

186. An 8-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes, cables, valves, manhole covers, conductive and non-conductive sewer pipes and septic tanks by electronic means. Dry battery operated. Only one man is needed for operation. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif., by checking the coupon.

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During 1955 many sections of North America, never before visited by disaster, were ravaged by wind, water, hail, fire, explosion, and earthquake. Don't be complacent. You are not immune, but you need not be unprepared.

Winter, with doors and windows shut against the cold reduces the effect of a warning signal. FEDERAL can furnish larger and louder sirens. Is your present siren or alarm system adequate?

A good warning system should do more than announce a fire; it should alert your entire population to take cover or evacuate; it can also summon civil defense, first aid, and emergency crews.

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Don't be a victim!
Fire is not your only hazard!
Complete your "Disaster Warning System" now! You may be living on borrowed time! Write today for information on FEDERAL Fire Alarm and Air Raid Sirens.
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For Prompt Service Use The Coupon

Valuable Information on Water And Waste Treatment Instrumentation

229. Helpful data on pneumatic instrumentation, flow measurement, recording controllers and rapid sand filter control systems are included in a 16-page Bulletin 1-15. Get this from the Foxboro Co., Foxboro, Mass., or by checking the handy coupon.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Gen. Bulletin W-800 by checking the coupon.

Valuable Information On Prestressed Concrete Tanks

356. This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 211 East 37th St., New York 16, N. Y., or check the coupon.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the coupon.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc. Hagan Bldg., Pittsburgh 30, Pa. or check the coupon.

The LINE forms on the RIGHT!

For these NEW **PAYLOADER**® tractor shovels

We anticipated some of this demand....

But apparently not enough....

We're increasing our production....

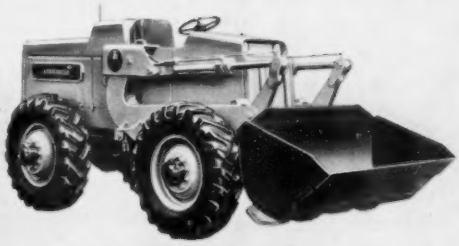
We're expanding our facilities....

However, since these new models outproduce and outperform other tractor-shovels, we expect the demand to increase even more. If you are interested in more production at lower costs, your future needs will probably include one or more of these new "PAYLOADER" models.

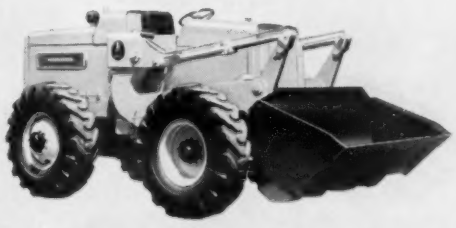
Because of the current demand we suggest you contact your "PAYLOADER" distributor *at once* and discuss your needs with him.

These new models have been designed and are being built by The Frank G. Hough Co. who introduced the first four-wheel-drive tractor-shovel and who have produced more unit-design tractor-shovels than all other firms put together.

model HU *1 cu. yd.*



model HH *1½ cu. yd.*



model HO *2 cu. yd.*

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REFLECTORIZE YOUR SIGNS

—at 1/10 the cost of ordinary methods

WITH Cataflex Reflective Coating Kits you can SAVE UP TO 90% on reflectorizing costs in your sign shop—no special equipment needed—no special training required. Your material costs with Cataflex can be AS LOW AS 10 CENTS PER SQUARE FOOT.

Cataflex Reflective Coating Kits consist of Binder, either clear-transparent or pigmented; high-index, high-intensity glass beads for wide-angle reflectance; and self-cleaning, waterproofing TOPKOTE—all that is needed to reflectorize your own signs at ONE-TENTH the cost of ordinary methods.

Colors available—red, yellow and white opaque, and clear-transparent. When ordering, specify drying method used—bake or air dry. Four kit sizes: Introductory—100 sq. ft.; Standard—600 sq. ft.; Economy—3,000 sq. ft.; and Super 6,000 sq. ft. Complete instructions with each Kit.

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Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

Precision Line Locator Speeds Maintenance Work

202. Accurate location of buried pipe and cable is made easy with the compact, all-purpose Wilkinson Line Locator, made by Wilkinson Products Co., 3987 Chevy Chase Dr., Pasadena 3, Calif. One-man instrument finds depth as well as location, saves "guesswork" excavations. Get latest data by checking the coupon.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

What You Should Know About Fluoridation

217. A helpful publication entitled "Fluoridation" which describes the development of fluoridation and lists the chemicals and dosages normally used has been prepared by Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Copies of publications on both solution and dry feed W&T Fluoridators are also available. These publications are yours for checking the coupon.

Portable Sump Pump Needs No Priming

324. The BJ Pneumatic Sponge Pump, a self-contained air-powered unit, is built for heavy duty dewatering use on all construction jobs. Full details on this lightweight portable sump pump are contained in Bulletin No. 543-3-900, available from Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles 54, Calif., or by checking the coupon.

Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwaukee 14, Wis. Detailed specifications are included. Check the coupon for your copy.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the coupon for your copy.

What You Should Know About Meter Setting and Testing Equipment

413. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All water works men concerned with setting and testing meters will want a copy of this catalog, No. 56. Check the coupon for your copy.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the coupon for your copy.

Portable, Standby Or Continuous Power

440. Generators and power plants for emergency, portable continuous power are described fully in literature available from Katolight Corporation, Box 891-107, Mankato, Minnesota. Information on motor generator sets, high frequency changers and independent generators up to 400 K.W. is included. Check the handy coupon today.

Look to LEOPOLD for the finest in Water Purification and Sewage Plant Equipment

Filter Operating Tables

Leopold Operating Tables are available in a number of standard models to meet a wide range of requirements. In cases where special features are needed, a Leopold representative will be glad to assist in the design and selection of equipment best suited for the particular installation.

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SPEEDS MOWING—For fast, clean roadside mowing, try a Ford Tractor and Rotary Cutter. Ideal, too, for golf-course rough, park areas, cemeteries and institution grounds.

CUTS EXCAVATING COSTS—Ford Tractor and hydraulic backhoe is widely used for water, gas, sewer and street department work. Used by smaller cities for sanitary landfill garbage disposal.

DIGS TRENCHES FOR LESS—Ford Tractor and trencher digs up to 800 lineal ft. per hour. Saves time and labor on street construction, utility-service connections, sewer and drainage systems.

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Birmingham, Michigan

More and more economy-minded Federal, State and Local governmental agencies are stretching tax dollars by replacing manual labor with efficient Ford Tractor power. That's because Ford Tractors get more work done at lower cost—handle a wide variety of jobs throughout the year.

You'll find Ford Tractors and Equipment used to save money on highway and park mowing . . . excavating and trenching . . . materials handling . . . snow removal . . . road and street maintenance. One big advantage is that a single Ford Tractor can handle *all* these jobs—stay busy every day in the year. Contrast this with expensive special-purpose equipment that works during one season, then sits idle the rest of the year!

Have a talk with your nearby Ford Tractor and Equipment Dealer today. He'll explain how Ford Tractor power can handle many of your jobs more economically. Ask him for comprehensive literature or write to the Tractor and Implement Division, Ford Motor Company, Birmingham, Michigan.

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"CENTURY"® PIPE

cuts costs, saves tax dollars!

Across America, thrift-conscious communities are recognizing the economy of "Century" Asbestos-Cement Pipe. Whether used in extending old water mains, or in installing new water distribution systems, "Century" Pipe brings the advantages of low cost . . . ease of installation . . . remarkable durability.

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Investigate the many other important advantages of "Century" Asbestos-Cement Pipe and you'll fully understand why it's in growing demand—why it's the best choice for your next water main installation! *Write today for a copy of our free booklet, "Mains Without Maintenance."*

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K&M best in asbestos®

Thousands use our Readers' Service to keep up to date . . . do you?

AUTOMATIC HARDNESS TESTER on each softener makes soap tests at required intervals. When the water tests hard —regardless of the volume treated—the tester automatically activates the multiport valve that regenerates the softener . . . insuring maximum runs and uniformly soft water despite variations in wells.

AUTOMATIC MULTIPORT VALVE, being checked by operator Bob Fox, takes a softener out of service, backwashes, regenerates and rinses the bed and returns the unit to service —smoothly and automatically—with no attention or supervision.

East Aurora goes "automatic" and cuts water-softening costs

WHEN POPULATION JUMPED TO 6,800, East Aurora increased pumpage by 72% from 320,000 to 550,000 gpd. Even at this increased volume, they cut salt costs $4000 a year! They also ended a red-water problem by reducing iron from 1.3 ppm to 0. And they use the *same manpower!*

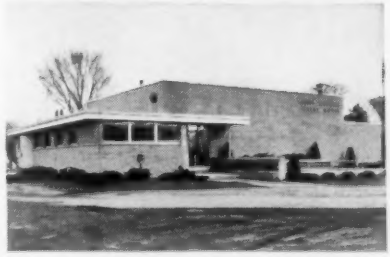
HOW WAS IT DONE? The increased volume and salt savings were accomplished by using Permutit Q, a high-capacity ion exchange resin with low salt consumption. The iron problem was solved with two Permutit filters. Manpower was not increased because the automatic hardness testers eliminated manual testing. And the efficiency of Permutit's automatic multiport valves frees the operators for other plant duties.

WHY PERMUTIT? "We started with Permutit equipment in 1935, and it worked out so well that we called on Permutit again for our 1950 expansion," says Village Engineer E. J. Maurer.

PERMUTIT WILL WORK WITH YOU to modernize your present plant or to plan a new one. Call us early in the planning so we can be of most help. The Permutit Company, Dept. PW-11, 330 West 42nd Street, New York 36, N. Y.

PERMUTIT® WATER CONDITIONING

Equipment • Resins • Experience



A 51% increase in population caused East Aurora, N. Y. to expand and modernize its water works. Wooden structure (above) was replaced by a modern brick building which contains the latest in water conditioning equipment.

Now's the time to mail this month's Readers' Service Card.

RED

Marks the DANGER SPOTS

Road markers — signals — change with state lines—but everywhere RED means [illegible] – DANGER. It is an instant warning universally recognized. That is why DIETZ Lanterns are the standard of the world, for over a century, wherever portable SAFETY warnings are required.

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Dietz Lanterns say stop. A complete line of economical, long burning, ruggedly made kerosene lanterns available with Ruby, Clear, Blue, Green or Amber globes.

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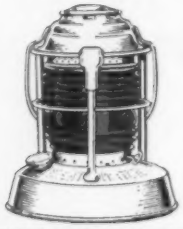

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Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association

Community Facilities Lack Worries Builders

Washington officials of the National Association of Home Builders predict that the problem of community facilities will be one of the thorniest facing communities and home builders in the next decade. James W. Pearson, executive vice president of the Washington Home Builders Association says that "Community facilities are a collective responsibility and not the responsibility of the builders, the new home owner or any other individual group." Community facilities such as schools, sewers, water facilities, recreation areas, roads, etc. present major financing difficulties and that it is "unfair to expect the home owner to bear the brunt of the expense for facilities which serve an entire community," he said. In his opinion, the solution will take years and will require legislation at the state and local levels to "break through the economic and administrative barriers that now stand in the way of sound planning." In preparing over-all plans, he called for some thought to be given to "the consolidation of annexation of smaller communities, the establishment of so-called metropolitan areas and the reorganization of local governing and regulatory bodies."

HHFA Slates Demonstration Projects on Urban Renewal Program

HHFA's Urban Renewal Administration plans a series of "pilot projects" in selected cities to demonstrate how municipalities can avail themselves of the benefits of urban renewal and redevelopment projects under the Federal Housing Act. Planned is a program that will come up with patterns and procedures adaptable to all communities. Early announcement of the pilot cities is expected.

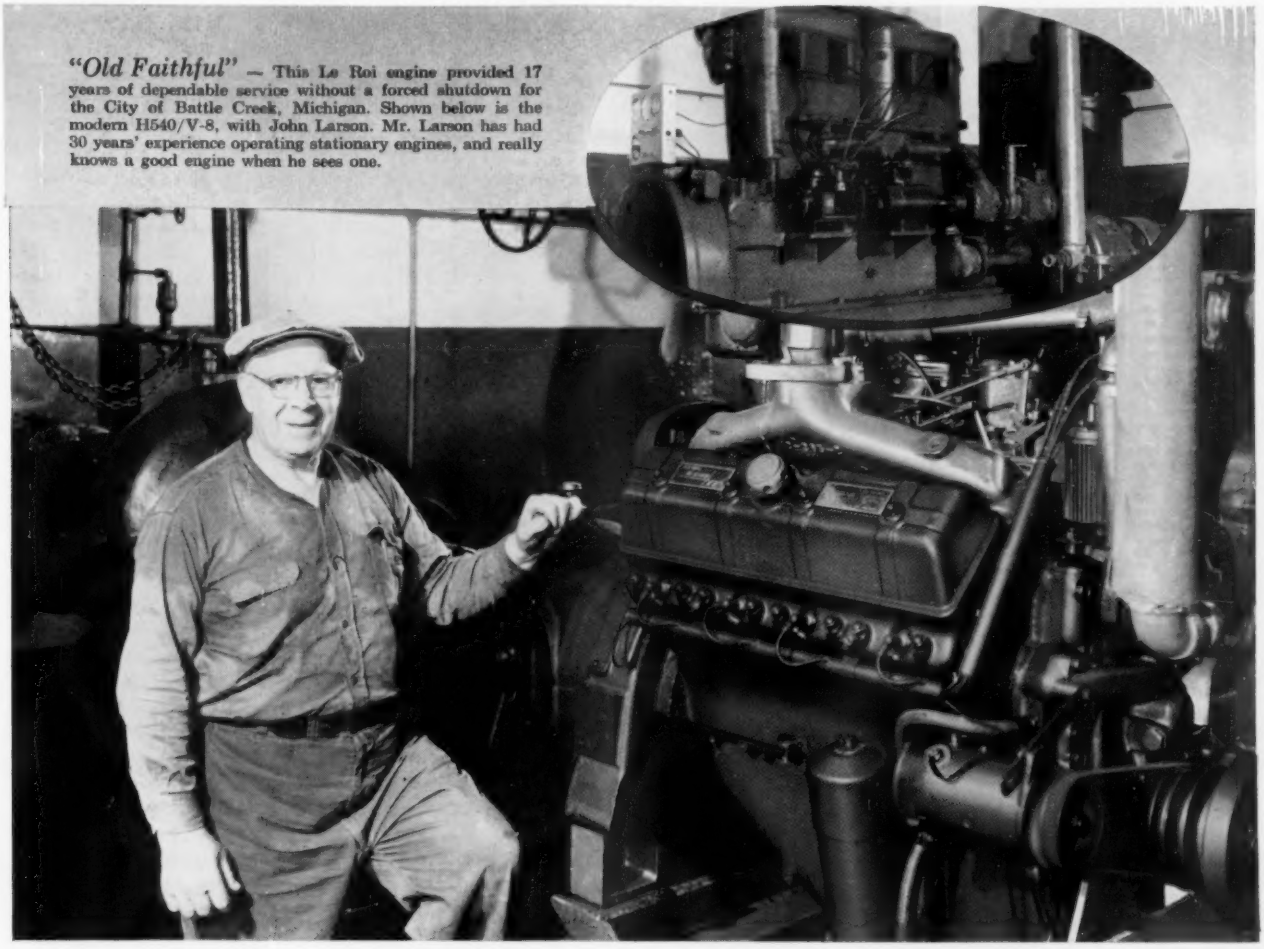
A brief, concise description of the need for, nature of and benefits to be derived from a workable program for urban renewal is provided in "The Workable Program—What It is," just published by the Housing and Home Finance Agency. Copies of the 10-page booklet may be purchased for 10¢ from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Water Supply and Germ Warfare

The Federal Civil Defense Administration has warned that water distribution systems in American municipalities can offer attractive targets for biological warfare attack, but measures can be taken now which would discourage use of such weapons. The water distribution system is a more attractive target than the water supply area, warns the FCDA. Less material would be needed if injected into the distribution system and if present chlorination systems could be bypassed. The FCDA maintains that at present "chlorination, in spite of certain shortcomings, remains the best single protective practice," provided it is properly administered to extend throughout the entire water distribution system. Public utility officials are also urged to consider: (1) Reinforcement of security measures at all critical structures of the distribution system as well as the source of supply; (2) Establishment of effective liaison between water quality labs and special microbiological laboratories of official CD agencies; (3) Location of auxiliary, dependable, safe and easily protected alternate sources of drinking water; and (4) Acceleration of sabotage prevention and perfection of warning devices.

Increase in Construction Projects

Between now and next July, the two big Federal pick-and-shovel brigades—the Army Corps of Engineers and the Interior Department's Reclamation Bureau—will start or resume work on 109 sizable



"Old Faithful" — This Le Roi engine provided 17 years of dependable service without a forced shutdown for the City of Battle Creek, Michigan. Shown below is the modern H540/V-8, with John Larson. Mr. Larson has had 30 years' experience operating stationary engines, and really knows a good engine when he sees one.

122,105.6 hours logged with only four overhauls

...dependable performance like this proves the value of Le Roi engines

In 1937, the City of Battle Creek installed its first Le Roi engine. Seventeen years later, when it was time to modernize, this engine had piled up the amazing total of hours shown above.

This is just one more example of Le Roi dependability. It is also proof of the excellent maintenance work performed by John Larson and his staff.

In 1954, "Old Faithful" was replaced by Le Roi's H540, a modern short-stroke V-8. The H540 normally operates at 1500 rpm, but, because of its short stroke V-8 design, piston speed is no greater than that of longer stroke, slower speed engines.

Moreover, the H540 provides new flexibility. This flexibility really paid off during flood conditions when the electric pumps were shorted out. The H540 ran up to 2100 rpm and, by so doing, carried the entire plant load for several days.

Performance during this emergency clearly indicated the advantages of the H540's short-stroke V-8 design. It proved that you get more horsepower per dollar and more horsepower per space. Other plus factors are easier servicing and easier installation.

Whether it's for continuous or standby service, or for pumps, blowers, or generators, it pays to use Le Roi engines. Le Roi power is dependable, low-cost power — power that can help ease the tax load in your community. You can get it in sizes ranging to 645 hp., or in custom generator sets from 50 to 350 KW. Write us for detailed information.

E-103

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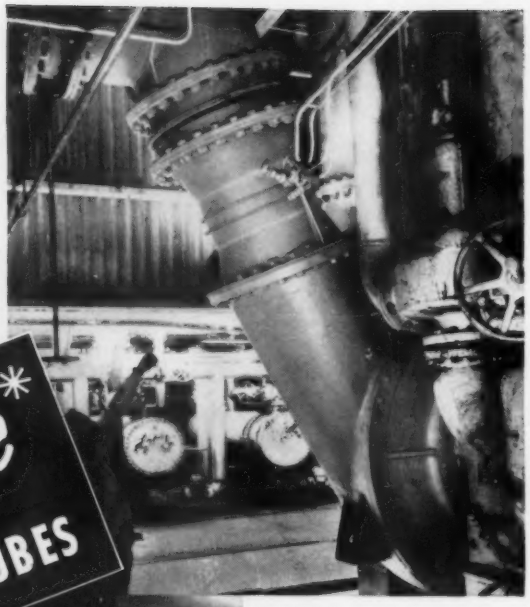

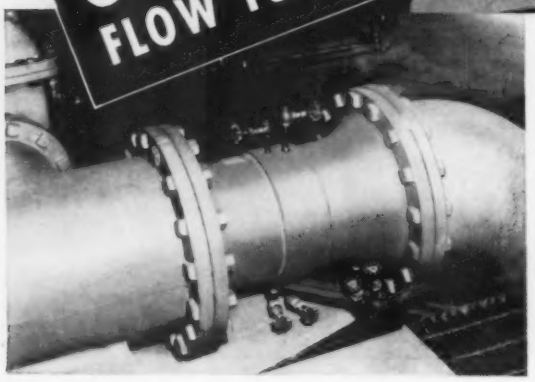

...THEY NEED SO LITTLE ROOM

Gentile Flow Tubes are short. They need only minimum straight runs entering and following, and can be installed at practically any accessible point where flow conditions are reasonably steady.

Flow Tubes are furnished with individual head capacity curves, and for unusual piping arrangements, calibration curves for simulated conditions can be furnished.

Guaranteed

- Accuracy
- Minimum Head Loss
- Reproducibility

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projects for irrigation, flood control, harbor improvement, beach erosion control and power generation. The total number of "new starts" for the two agencies is triple that of the fiscal year ended last June, and the greatest since World War II. These starts may be the largest ever. Nearly every state in the Union, plus Alaska and Hawaii, will feel some imprint of this bustle of activity. Projects being started range from a $20,000 effort to deepen St. Patrick's Creek in Maryland to the giant Trinity River project in Northern California, expected eventually to cost $219 million. The roster also includes work on the Painted Rock Reservoir in Arizona, Nawiliwili Harbor in Hawaii, Hammonasset Beach in Connecticut, Apalachicola Bay in Florida and McGeen Bend Dam in Texas.

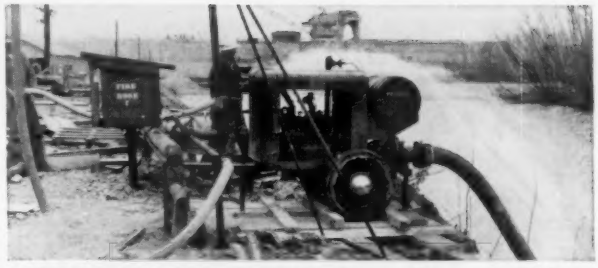
The expansion promises increasingly-acute spending problems for the Administration in the fiscal year starting next July and in the following year. The total eventual cost of the 109 new projects is now reckoned at $1.8 billion; they alone likely will require about $500 million a year of Federal spending in each of the next few years, aside from outlays to complete projects begun in the past few years and to start any other new jobs Congress may authorize.

Public works projects continue to grow in scope and dollar value with the effect being felt in every section of the country. At the same time announcement was made of the fact that construction contracts for 213 projects to aid in stream pollution abatement through providing treatment of sewage from municipalities, institutions, and other significant population centers, were awarded by cities of the Nation during the second quarter of 1955, according to reports made to the Public Health Service, U. S. Department of Health, Education, and Welfare. The contracts totaled $51.3 million and covered 108 new plants and 105 additions, enlargements, or improvements to existing plants.

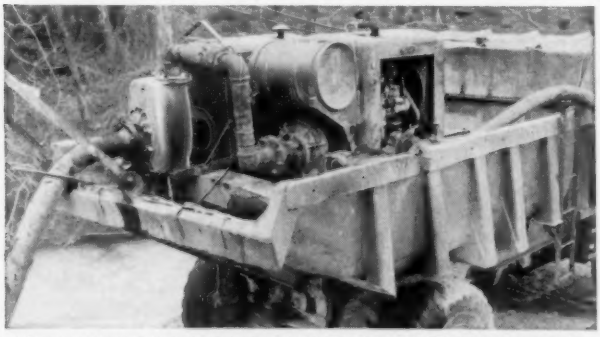
Of the 108 new plants, costing $23.3 million, only six were for plants serving more than 25,000 population. They were: Cincinnati, and Portsmouth, Ohio; Lombard, Illinois; St. Petersburg, Florida; Lake Charles, Louisiana; and Parkersburg, West Virginia. These six accounted for 34.4 percent of the total new plant cost. More than 75 percent of the new plants will serve places of fewer than 5,000 population.

How to wash your face with Jaeger pumps

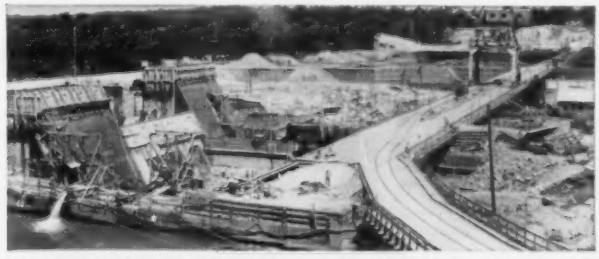
TO SCOUR THE FACE OF THE TAILRACE CUT for Virginia Electric and Power Company's power station dam at Roanoke Rapids, N. C., Stone & Webster used this ingenious set-up. Two Jaeger pumps (a self-priming 6P and high pressure 5CPH, connected in tandem) traveled in dump truck. Jets with 15/16" nozzles were handled from platforms on crawler-mounted crane. Moving along the cut, they knocked all loose rock and earth from the face with two powerful streams each shooting 370 gpm at 170 lbs. pressure. This method was also used to scour the rock before pouring wings of the dam.



EMERGENCY FIRE PROTECTION: Stone & Webster set up other Jaeger 5CPH pumps like this for standby protection against fires. Their capacity and pressure exceeds that of standard 500 gallon "pumpers".



SURE-PRIME AND HIGH PRESSURE TEAM TOGETHER: Jaeger 6P, which maintained prime automatically, was connected in tandem to a Jaeger 5CPH which boosted water pressure to 170 psi. Pumps were set up in dump truck for easy moving along job.



GENERAL VIEW OF CONSTRUCTION, Roanoke Rapids Power Station of Virginia Electric and Power Co., built by Stone & Webster Engineering Corp. Eleven Jaeger pumps were used on this job.

For full information on Jaeger dewatering and pressure pumps, see your Jaeger distributor or send for catalog P-4.

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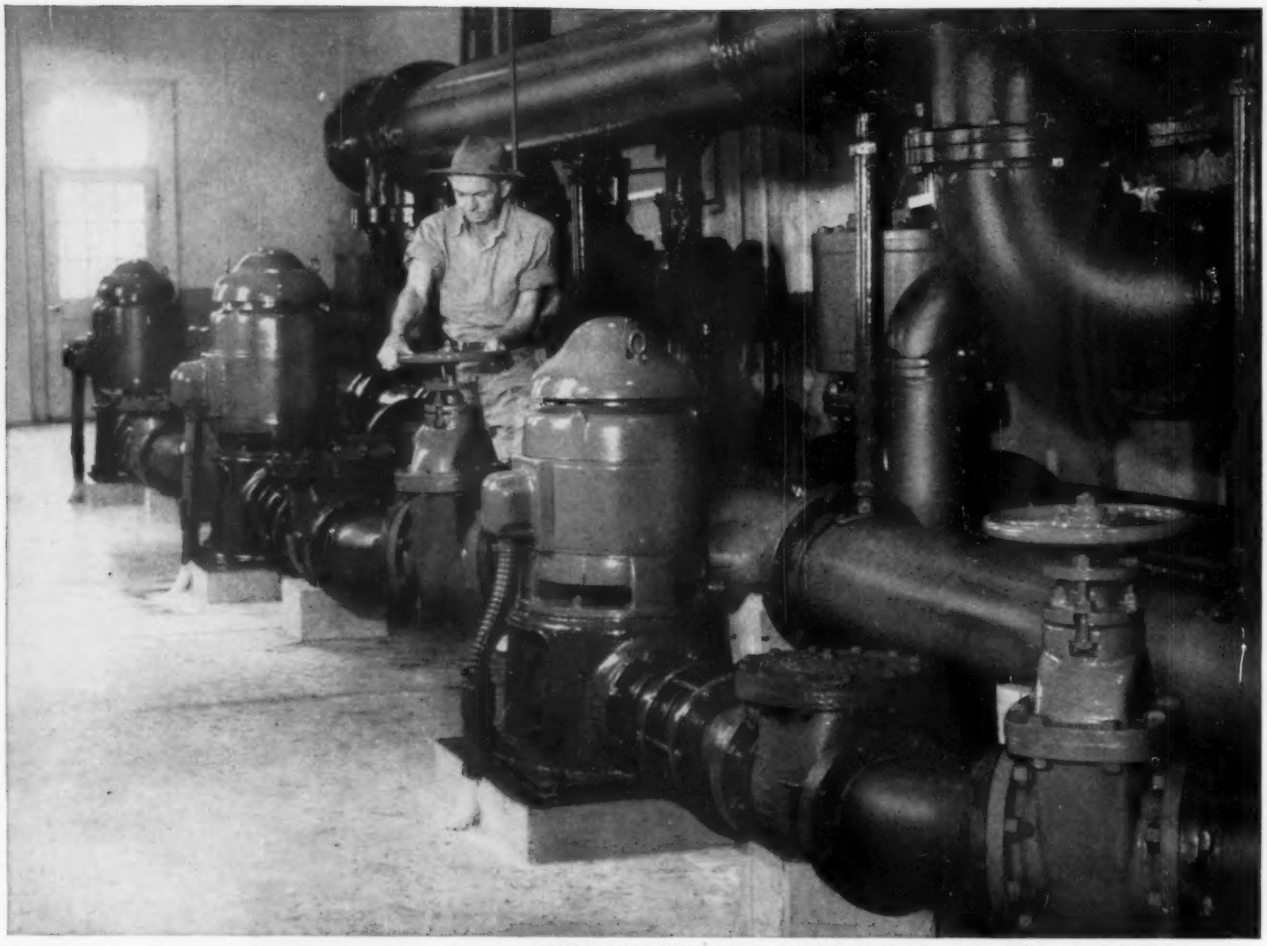

THREE WORTHINGTON VERTICAL TURBINE PUMPS lift water 66 feet in the dual-purpose water treatment plant in Pulaski, Virginia.

Pulaski's new plant softens hard water, hardens soft water

Seems that the main source of water for Pulaski, Virginia, is a small impounding reservoir where the water is extremely soft.

When the reservoir runs low, Pulaski draws from a limestone spring. Water here is unusually hard.

To deliver water of uniform quality all year 'round, the Pulaski plant has to soften the hard water — and harden the soft water.

Pumps for this unique plant were supplied by Worthington. Three Worthington vertical turbine units transfer water from the plant's clear well to the general distribution system. Pulaski's engineers are well pleased with the Worthingtons because they take up so little floor space and need no priming facilities or foot valves. The three pumps are installed in a 16-foot deep clear well and lift water 66 feet at exceptionally high pumping efficiencies.

Why not learn how the modern Worthington vertical turbine pump can help in your operation? Write for free Bulletin W-450-B40 to Worthington Corporation, Vertical Turbine Pump Division, Harrison, New Jersey. D.4.28

WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

CONSERVE GROUND WATER—IT IS A VALUABLE RESOURCE

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In SOUTH AFRICA too . . .

TYLOX
Rubber
PIPE JOINTS

are specified to make waste lines

★ ***LEAK-PROOF***
★ ***CORROSION-RESISTANT***
★ ***LONG-LASTING***

Here, a native African installs high pressure TYLOX Gaskets (bell assembly type) shipped from half way around the world to couple this pipe and protect its joints against leakage and acid attack.

The project, at Sasolburg, Orange Free State, South Africa, called for over 50,000 feet of TYLOX-jointed pipe for disposal of *both* sewerage and industrial wastes. It was a joint project of the Town of Sasolburg, and The South African Coal, Oil and Gas Corporation, Ltd. Pipe was manufactured and laid by The Roberts Construction Company, Ltd.

The question "what joint?" for this double-duty line was quickly resolved by the designers . TYLOX — which cuts construction costs by speeding pipe work, leak-proofs joints by its compression seal, and never deteriorates because of the special compounding of its rubber — was the *only* pipe joint fully meeting their requirements for pipe line economy, safety and longevity. And they were willing to go half the world away to get it.

WRITE FOR OUR NEW TYLOX BOOKLET . . .

. . . read the facts on TYLOX, the only flexible joint meeting requirements of designer, builder and taxpayer alike. See why TYLOX is specified for big, important pipe jobs all over the world. Specify TYLOX to assure economy, safety and longevity on your pipe projects.

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new life for old wells with **Weltone!**

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HERE IS WHAT HAPPENED:

BEFORE CLEANING the well capacity had fallen off from 250 gpm to 50 gpm in less than one year. Water supply was inadequate, and pumping costs had risen.

AFTER WELTONE CLEANING the well capacity rose to over 280 gpm and has remained constant at that level for over 2 months. THIS IS A 367% INCREASE IN CAPACITY. Water supply is adequate now, and pumping costs have come down.

WELTONE combines in one product all of the qualities desirable in a well cleaning compound. It is safe—will not harm metal or concrete and forms no dangerous fumes. WELTONE sterilizes, destroying iron fixing and other bacteria as it cleans, and it is specially processed to dissolve readily.

WELTONE is just as effective at developing new wells as it is at cleaning old ones. Drilling muds and the quartz, mica and other materials which can prevent new wells from developing their full capacity are readily removed with effective, easy-to-use WELTONE.

Write today for the free descriptive folder containing complete information on the remarkable well cleaning properties of WELTONE.

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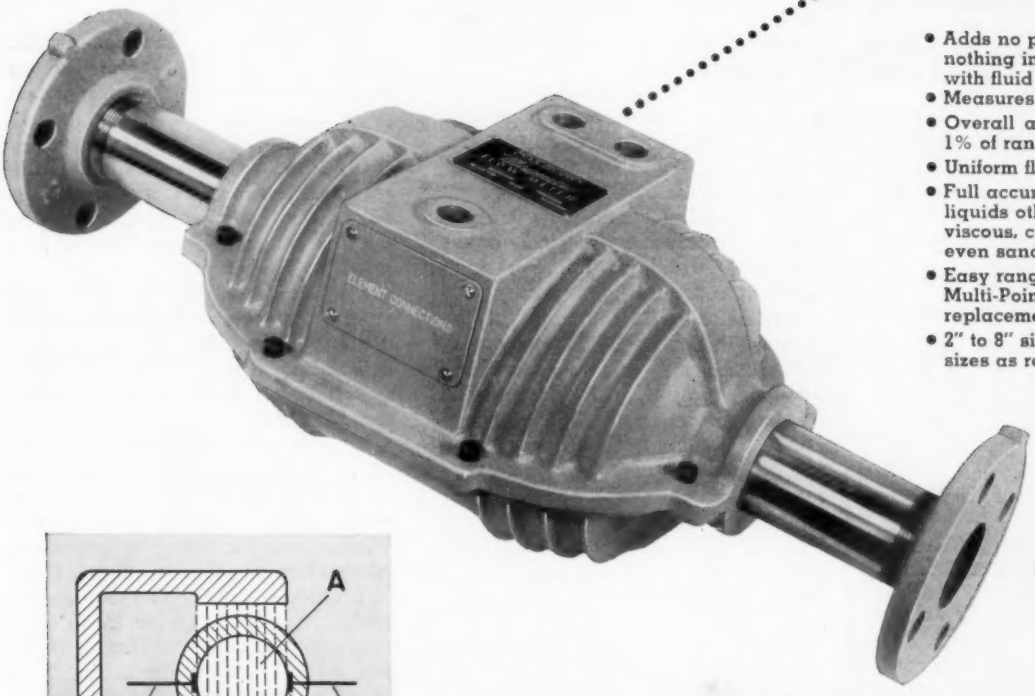
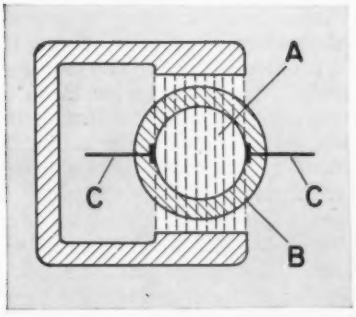
NEW! a flow meter with no flow restrictions!



- Adds no pressure drop — nothing inside pipe to interfere with fluid flow.
- Measures fluid velocity directly.
- Overall accuracy better than 1% of range over entire scale.
- Uniform flow scale.
- Full accuracy sustained even on liquids other meters can't handle: viscous, corrosive, or pulpy — even sand-water slurries.
- Easy range change — either by Multi-Point Switch or range coil replacement, as preferred.
- 2" to 8" sizes standard — larger sizes as required.

FOXBORO MAGNETIC FLOW METER



SIMPLE, TROUBLEFREE, OPERATION

The Foxboro Magnetic Flow Meter operates on the same principle as a power generator. A magnetic field (A) is maintained through a standard pipe section (B) of stainless steel or other non-magnetic material. This pipe section is lined with Kel-F® or other insulating material. Liquid passing through pipe acts as moving conductor, generating an electric voltage which varies in proportion to liquid's average velocity. Flush electrodes (C) in pipe wall "pick up" this voltage which is recorded in desired flow units by Dynalog Electronic Recorder or Controller.

This premium-performance meter measures *magnetically* the flow rate of virtually any liquid except hydrocarbons. It completely ignores such common metering headaches as turbulence, suspended solids, and variations in conductivity, density, and viscosity. It even measures reversing flows.

Installation is simple. The magnetic spool piece connects into the line like any equivalent length of pipe — no seals, purges, meter runs, or straightening vanes required. Connects by 2-conductor cable to remote Dynalog Electronic Flow Recorder.

Maintenance is practically eliminated. There are no pressure taps to become plugged or frozen, no working parts to foul.

Foxboro Magnetic Flow Meters are already in use on such widely different liquids as beer, sand-and-water, rosin size, rock-and-acid slurry, viscose, and highly corrosive liquid detergent. Find out how this precise, troublefree flow meter can help *your* processing. Write for complete details.

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Dodson's Digest

Ice control begins at home

Drove out to see Jim Phillips the other day. Jim is a county road commissioner, and I wanted to talk to him about Calcium Chloride. But I couldn't get his mind off the new car he had just bought. He insisted on taking me out for a ride, so I slid into the seat beside him, and we headed for the highway.

"Look how this car hugs the road," Jim said, as we took a sharp curve with no apparent effort.

We came to a clear stretch of highway, and Jim started to speed up. "Look at that speed, Dod!" he exclaimed. "And my foot is still two inches from the floor."

We turned around and headed back toward Jim's office. "I'm going to take good care of this car," Jim said. "In fact, I just had it winterized – put in antifreeze, and . . ."

"Good idea," I agreed. "And speaking of winterizing, I hope you've got your road-maintenance operations winterized, too. Your stockpiles should be treated with Calcium Chloride to prevent them from freezing, and to keep your abrasives free-flowing and easy to handle.

"And if you want speed, nothing melts ice as fast as Calcium Chloride. What's more," I continued, "Calcium Chloride melts ice effectively at any temperature you'll encounter.

"And talk about hugging the road! Calcium Chloride anchors abrasives firmly to the road, so they won't be swept off by wind and traffic. You'll need *less* abrasives, and . . ."

"Thanks for reminding me," Jim broke in. "I'll have to get some Calcium Chloride this afternoon."

"That's a good idea, Jim," I said. "You haven't much time before the stockpiles start freezing."

"Who said anything about stockpiles?" Jim laughed. "I've already treated *them*. I just want to take a bag of Calcium Chloride home with me. I'm not going to drive my new car on a slippery driveway!"

L. D. DODSON

P.S. — Get valuable information on ice control in our leaflet, "Melt or Skidproof Icy Surfaces with Wyandotte Calcium Chloride." For your free copy, just drop me a line. *Wyandotte Chemicals Corp., Wyandotte, Mich. Offices in principal cities.*

Wyandotte
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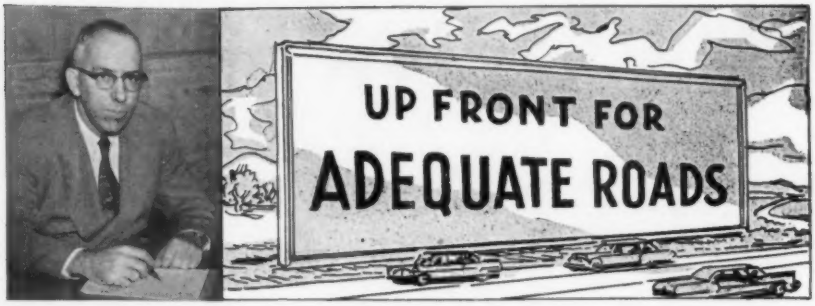
HEADQUARTERS FOR CALCIUM CHLORIDE



by LEO J. RITTER, JR.

Quite A Show—The General Motors Powerama was held (in September) in Chicago on the lakefront near Soldier Field. Covering an area of some 20 acres, it was a tremendous display of General Motors products. From a transportation standpoint, it was extremely interesting—included were a lightweight train, diesel locomotives, railroad cars of various types, and mobile electrical generating units; each of the motorcar divisions was represented with a "dream car" of the future; the newest in trucks and buses; the Navy's VTO (vertical take-off) aircraft, which is powered by an Allison engine; and various boats, including pleasure craft and fishing boats. There were a large number of units of road building equipment on display, all powered by GM diesel engines. Euclid had some of their biggest and newest machines on exhibit, including the new Twin-Power crawler tractor (powered by two diesel engines in tandem) and a 50-ton truck which was rigged up as a "swimming pool on wheels." All in all, it was a fascinating show—one that emphasized the contribution that General Motors is making to the economy of the country. The cost to General Motors must have been terrific, but nearly 2¼ million people attended during the three weeks it was in progress.

How To Improve Traffic Flow—Sometimes your writer has the feeling that not all cities, towns, and villages remember all of the basic methods which are used so widely to improve the flow of traffic over existing street systems. For example, is your city making full use of the following devices?

(1) One-way streets. Particularly in downtown areas where traffic conditions require them and physical conditions permit.

(2) Turn restrictions. Particularly in downtown locations where traffic is heavy in all directions.

(3) Restrictions on curb parking. Where curb parking interferes with traffic movement and reduces the traffic capacity of the street.

(4) Reversible flow of traffic. Either on one-way streets or on certain lanes, in situations in which peak hour flow is predominantly directional.

(5) Improved signalization. Utilization of the most modern and most efficient signal control methods, both in congested areas and at isolated intersections.

(6) Development of secondary arterial streets. Development of through streets, through proper usage of signs and signals, in order to relieve the load on principal arterial streets.

How does your community stack up in these respects? Although we have probably listed them before, there are several publications which are outstanding in providing information of value in solving traffic problems; they are recommended reading, particularly for those who have responsibility for traffic matters, but are not experts in the field. Three of these are available from the Association of Casualty and Surety Companies, 60 John Street, New York, N. Y.—The Manual of Traffic Engineering Studies ($3.75); Getting Results through Traffic Engineering (a series of case studies—free); and The Traffic Engineering Handbook ($6.00). Another is the Highway Capacity Manual, published by the Bureau of Public Roads and Available from the Superintendent of Documents, Government Printing Office, Washington, D. C. ($0.65).

Military Publications—As some of you know, one of the things your writer has been doing lately is working on publications of the Corps of Engineers. In the course of this work, we've run across some pretty good publications—things prepared basically for the Army, but which contain good information for civilian use. Four currently available are TM5-252, Use of Road

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4 WATER CONTROL ADVANTAGES WITH THE RODNEY HUNT HY-Q FLUSH BOTTOM CLOSURE SLUICE GATE!

1. You get MAXIMUM flow because there is neither concrete barrier behind the gate nor pocket below it to set up turbulence when the gate is open.
2. You get MAXIMUM drainage because chamber or channel drains naturally to the bottom level over the flush invert.
3. You get MAXIMUM clear opening because full flow at every raising of the gate clears the channel of silt and debris.
4. You get MAXIMUM hydraulic gradient because the gate seats at the lowest level of the channel.

The Patented HY-Q* Flush Bottom Closure Sluice Gate seats on a resilient rubber seal flush with the bottom of the channel. This patented feature eliminates bottom wedges and the trough in which they descend . . . eliminates the concrete barrier against which many conventional gates must seat . . . gives you design flexibility in water filtration, sewage treatment and practically all sluice, dam, channel and chamber flow control. For complete details of the Rodney Hunt patented HY-Q Gate send for Bulletin 75.

* *HY-Q is a trademark of Rodney Hunt Machine Co.*

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and Airfield Construction Equipment; TM5-541, Control of Soils in Military Construction; TM5-233, Construction Surveying. TM means Technical Manual. Another one, which will not be available for a year or so, is TM5-250, Roads and Airfields; it is now available as a special text, ST5-250-1 (1948). All these originate with the Engineer School, Fort Belvoir, Virginia but are *not* for sale, which is unfortunate. Probably the easiest way to get hold of them is through your local Army reserve unit, particularly if it is an Engineer outfit. Another way might be through the ROTC unit at your local college or university—again particularly if there is an engineer unit. Another type of thing is a whole series of technical books—the Engineer Manual for Military Construction, published by the Office of the Chief of Engineers, Washington; this manual is used in the design and construction of facilities in the zone of the interior—permanent installations. It is not for sale, either.

Clever—Every so often, we send in one of these request cards for manufacturers' literature—it's a real easy way to keep up with new developments in equipment and materials. We get all sorts of responses—letters, literature, visits from distributor salesmen, etc. Recently, one of our requests was for new information on "No-Strip", the chemical additive, which is used in bituminous paving mixtures to eliminate film stripping in the presence of water. Well, the No-Strip (what a name!) people sent us a bulletin and a "No-Strip Test Kit" containing aggregate, bituminous material, No-Strip, and a stirring rod, so that the recipient can make his own "laboratory" test and judge the effectiveness of this additive for himself. Pretty clever, eh?—and certainly effective in selling the product.

Variable Toll Road—An interesting report is one issued recently by Bureau of Municipal Research (Philadelphia) and the Pennsylvania Economy League. It recommends construction of the proposed Delaware Expressway—23 miles from the Bristol area in Bucks County to the new Delaware River Bridge in South Philadelphia—as a toll facility, preferably with variable tolls. On a facility of this kind—which has never been operated in this country—the amount of toll might be made variable with the time of day, day of week, month of

Now's the time to mail this month's Readers' Service Card.

Melt more ice and snow—faster

Cover more road mileage —faster

WITH STERLING *AUGER-ACTION* ROCK SALT

Auger-Action Rock Salt melts ice faster (up to 48% faster!). Auger-Action's multi-size crystals bore clear through to break the "seal" between ice and pavement. In minutes, they turn snow into slush for quick removal. Roads become safer —faster—when you use Auger-Action Rock Salt.

Auger-Action Rock Salt covers more mileage faster. Just one truckload of Sterling Rock Salt covers as long a stretch of road as five truckloads of abrasives! It takes only 500 lbs. to treat a mile of two-lane highway.

Cleanup expense eliminated. Auger-Action Rock Salt is gone with the snow and ice it melts. There's no residue left over. This means big savings in bare-pavement maintenance.

Shipment the way you want it. You can get this fast-acting Rock Salt in carloads or by truck in bulk, or in handy 100-lb. bags. Order Sterling Auger-Action Rock Salt *NOW*, and be ready for low-cost ice and snow removal. Write International Salt Company, Inc., Scranton, Pa., or the nearest district sales office listed below.

STERLING SALT products... made by International Salt Company, Inc., Scranton, Pa.

SALES OFFICES: ATLANTA, GA. • CHICAGO, ILL. • NEW ORLEANS, LA. • BALTIMORE, MD. • BOSTON, MASS. • DETROIT, MICH. • ST. LOUIS, MO. NEWARK, N. J. • BUFFALO, N.Y. • NEW YORK, N.Y. • CINCINNATI, O. • CLEVELAND, O. • PHILADELPHIA, PA. • PITTSBURGH, PA. • RICHMOND, VA.

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the year, length of trip, and type of trip. The main idea here would be to assure that traffic of economic priority—like trucks and buses—could move rapidly at all times. Second-priority traffic would be limited during peak hours, but would be encouraged to use the expressway during off-peak hours.

Construction Levels — Construction of all sorts continues to boom, with activity so far this year being 13 percent ahead of the all-time record established in 1954, according to the Associated General Contractors of America. A recent telegraphic survey by the AGC indicates clearly that a new record of approximately $42 billion of construction will be established this year. Competition will continue to be intense in most sections of the country—in many areas, low bids have been consistently below engineers' estimates in the last few months. A tightening of credit by the federal government will slow construction in some areas, but its overall effect seems to be slight. An annoying shortage of materials—particularly cement and steel—is plaguing builders in some areas and is expected to continue for some time.

The Future of Aviation—Official estimates of aviation activity for 1965 by the Civil Aeronautics Administration predict marked gains by all branches of the industry. For example, CAA expects the domestic airlines to carry 70 million revenue passengers, more than double the 32.3 million carried in 1954. Another prediction is that air transport's share of the common carrier markets will rise from its current 29 percent to more than 50 percent by 1965. Although expanded use of helicopters is included in these predictions, there is little doubt that aviation's growth may be even greater than these figures indicate, if the helicopter is fully exploited in both passenger and cargo service.

People and Places—The Governors Conference, held last summer in Chicago, restated its "approval and support of a greatly expanded federal-state program for construction of interstate highways". Significantly, the Governors didn't recommend any method of financing such a program. The BPR predicts that there will be a registration of more than 61 million vehicles in the U. S. this year. Traffic deaths hit the appalling total of 3340 in July, the highest for that month since 1937. December 1 is to be S-D day for 1955. The annual meeting of the AASHO will be held in New Orleans, December 4-9. Scott Reynolds, Assistant State Highway Engineer of Florida, died recently in South Carolina; he was only 52. The Ohio Turnpike was opened to traffic—all 241 miles of it—on October 1. Completion of this facility marks a major step toward the goal of being able to drive from Chicago to New York on high-speed, safe highways, with nary a stoplight. This time next year, that dream should be a reality. Fabric-in-asphalt (bituminous concrete reinforced with welded wire fabric) was used in a major resurfacing project at Willow Run Airport in Detroit last summer.

• • •

LUCIUS D. BARROWS, Chief Engineer of the Maine State Highway Department, has retired after 45 years of extraordinary service to his state. He has been chief engineer since 1928; and, in addition to his work for his state, has been an active leader in many engineering and highway organizations.

Plan with Quality...

Pekrul

4-36" Pekrul model 45A Sluice gates at Sacramento Sewage Treatment plant

City managers...engineers... contractors...know that the precision engineering and quality construction of Pekrul Gates means a *planned* water control project that will fulfill its purpose. It costs no more to plan with quality...specify Pekrul Gates on your next project.

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Ever Have a "Lights On" Celebration in Your City?

A "Lights On" celebration is a real community occasion. Often an entire town, thousands strong, turns out to see a public official switch on new street lights for the first time.

Why?

One big reason, of course, is the carnival atmosphere. Usually there's a parade, gaily decorated floats, a band or drum and bugle corps, and fireworks. Often the winner of a "parade queen" beauty contest reigns over the fun. Maybe there's a street dance or community "feed" right on Main Street itself.

But there's always a more important reason underlying all this public interest: people *want,* and appreciate, good street lighting. They know they prefer to shop along well-lighted streets. They know they're safer when walking or driving along well-lighted streets. They come to a turn-on ceremony which they know will make their city's lighting compare favorably with neighboring communities.

In short, good street lighting comes to be a bright, visible symbol of the services the people expect—and get—from progressive municipal officials.

Why not talk over your city's street lighting with your local electric utility? You'll find them glad to help you in arriving at planned, practical solutions to your street lighting problems!

"OUT OF DARKNESS," *a new, dramatic film story of how one community met its street lighting problems, is now available to civic groups, community service organizations, etc. This 16-mm, sound, black and white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest G-E Apparatus Sales Office.*

Section E455-1
Outdoor Lighting Department, General Electric Company
1400 Western Avenue, West Lynn 3, Massachusetts

Please send me a free copy of the 24-page bulletin, "Light The Way to A Better Community."

Name.....

Street.....

City.....**State**.....

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DALLAS BALTIMORE

A G-E PROGRESS REPORT

ON THE RISING

TREND TO FLUORESCENT

More Progressive Cities Adopt Newest Street Lighting Source

Five years ago General Electric introduced fluorescent street lighting to the United States. Today, thousands of these new luminaires are in service all over the nation. Fluorescent's growth rate is higher than that of any other outdoor lighting source.

What are the reasons for this unusually rapid growth?

IMPROVED VISIBILITY

Doubtless the leading cause of fluorescent's rise to popularity is the great improvement in visibility which it brings about. Some lighting experts say that you see about one third better on a fluorescent-lighted street than on one illuminated to the same level by mercury or filament luminaires. This improvement

NATION'S LARGEST fluorescent street lighting installation is inspected by Minneapolis officials. Flanked by G-E sales manager John Pike and lighting specialist Ernest Wendling, Minneapolis aldermen Frank V. Moulton, George E. Johnson, Jr., and George W. Martens watch installation of Form 206 luminaire.

3.3 MILES of Lake Street now have maintained illumination level of 1.5 foot-candles from G-E fluorescents. 500 of these units have been placed in service in this important business area. Installation is part of city-wide lighting expansion program.

"RECEIVED ONLY FAVORABLE comments on the new lights" says J. W. Monk, Dallas public utilities supervisor. Travis Winter, Dallas P&L, worked with Mr. Monk in obtaining decision to install more than 300 fluorescents in downtown Dallas.

EXCEPTIONAL "SEE-ABILITY" characterizes Lexington Street, Baltimore, under its new General Electric fluorescent street lighting. City and Baltimore Gas and Electric Company are also progressively relighting other areas.

is due to (a) reduced luminaire brightness, (b) improved pavement brightness uniformity and (c) excellent color quality from the "cool white" fluorescent lamp.

PLEASANT, "COOL-WHITE" LIGHT

There's no distortion of colors from the "cool white" light of fluorescent lamps. People's complexions and clothes, familiar objects, etc., look the same under this comfortable light as under sunlight.

MODERN APPEARANCE

The distinctive lines, up-to-date design, and functional beauty of the General Electric Form 206 luminaire make it an asset to any street's appearance.

LOWER MAINTENANCE

The average effective life of a fluorescent street lighting lamp is about two years! The hinged plastic globe enclosing the lamps is shatterproof. Neither the globe nor the light output is unduly affected by sun, rain, heat, cold, dirt, or aging.

LOWER COST

Compared on the basis of judged equivalent visibility with either color-improved mercury or filament, the G-E Form 206 fluorescent luminaire costs less than these other systems! While fluorescent equipment and amortization costs usually are somewhat higher, installation costs are about the same and operating and maintenance costs are generally lower.

MORE INFORMATION?

You can get complete information on the Form 206 fluorescent luminaire from your nearest G-E Apparatus Sales Office, agent, or distributor. Or, write Section 452-161, Outdoor Lighting Dept., General Electric Co., 1400 Western Ave., West Lynn 3, Mass.

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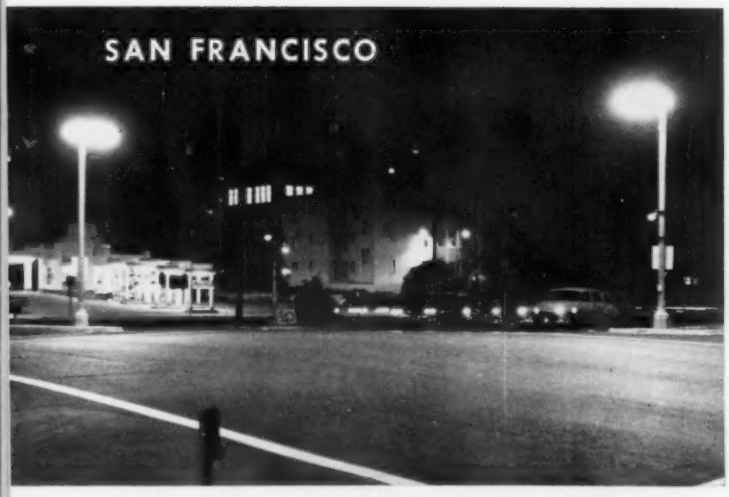

"ABSOLUTELY THE BEST" said S. Ivan Sandberg, of San Francisco's Department of Public Works, about the General Electric Form 206 luminaire. Intersection above is near famed Golden Gate Park.

"PAVEMENT GLARE IS REDUCED on Lexington Avenue during rainy or foggy weather" according to Armand D'Angelo, N. Y.'s Deputy Commissioner of Water Supply, Gas and Electricity.

2 NEW CAT*-BUILT TRAXCAVATORS

NO. 955 1½-yd. capacity

NO. 933 1-yd. capacity

THE NEW No. 955. High reach with fine stability is engineered into both this 1½-yd. capacity unit and its brother, the 1-yd. capacity No. 933.

"BIG-PRODUCTION" FEATURES!

40-DEGREE BUCKET TILT-BACK AT GROUND LEVEL. Large tilt-back at low bucket height for large loads every pass!

NEW OIL-TYPE CLUTCH. Lengthens clutch life, minimizes maintenance. Cuts costs 2 ways: (1) Clutch adjustment is rarely required. (2) Plate replacement is often unnecessary even at engine overhaul periods. Also provides easier shifting!

NEW MODERN HYDRAULIC SYSTEM. Insures delivery of full volume and pressure of oil for thousands of hours. Gives maximum protection against damage and dirt. Filter handily located for easy replacement of element.

PLENTY OF POWER. Power is ample for "burying" the bucket with fast lifting action and positive dumping under all load conditions.

"DESIGNED-IN" COMFORT. Operator sits high, has excellent visibility of all bucket positions. All controls easy and convenient—bucket controls a one-hand operation.

PERFECT BALANCE. Weight distribution, engine horsepower and bucket capacity are balanced so full length of tracks stays on ground at all times.

NEW 3-GROUSER TRACK SHOES. Proved on tough jobs for better traction—longer life.

OPTIONAL STARTING. Choice of 6-volt electric starting for starting engine or 24-volt direct electric starting.

VERSATILE ATTACHMENTS. To increase your job range—a variety of buckets and other useful attachments.

BRIEF SPECIFICATIONS	No. 955	No. 933
Flywheel HP at sea level	70	50
Bucket capacity, cu. yd.	1½	1
Bucket tilt-back at ground level, degrees	40	40
Bucket tilt-back at max. lift, degrees	47½	48
Dumping height (center of hinge pin to ground)	128"	118½"
Weight (approx.), lb.	21,480	15,500

BALANCED UNITS for bigger production and profits!

Designed and built as excavating and loading *units*, these two new Traxcavators are balanced to outproduce ordinary machines of the same capacity. Every part is backed by *one* manufacturer and serviced by *one* source—your Caterpillar Dealer. Whatever your job, you can't beat these as versatile, money-making tools. See your Caterpillar Dealer today—ask for demonstration!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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NEW BIG-PRODUCTION TRAXCAVATORS

● **COST ANALYSES** in the figures which follow are shown separately for each geographical subdivision as illustrated in Figure 1 at right. Considerable variations were reported by different sections of the country.

Lateral Sewer Construction Costs

JOHN J. BAFFA, Consulting Engineer, New York City

SEWER CONSTRUCTION COSTS were the subject of a questionnaire sent out by PUBLIC WORKS MAGAZINE in early 1954 to City Engineers throughout the country. In this questionnaire, the simple question was asked "What is the cost of sewers in your municipality including material, labor, trenching and overhead?" Usable replies to these questionnaires were received from 520 cities. A preponderance of data related to 8-inch, 10-inch and 12-inch sewers with scattered replies for larger sizes.

In order to obtain further data as to details of costs an additional questionnaire was sent out in early 1955. This questionnaire was sent only to those cities which answered in 1954. A total of 264 cities answered the 1955 questionnaire which, in general, asked the following:

a) Is sewer work done by city forces or by contract?

b) Are bids taken on a unit price lin. ft., or other basis?

c) What are unit costs of excavation for different depths; and of rock excavation?

d) What are unit costs for pipe and laying?

e) What are costs of pavement replacement and lawn area replacement?

f) What are manhole costs?

g) What soil materials are encountered and what are ground water conditions?

h) What does a sewer construction crew consist of with respect to number of men and pieces of equipment?

Analysis of the 1954 Data

Considerable variations in reported costs were found to occur with respect to geographical location. The data were therefore summarized in accordance with location. The geographical subdivisions chosen for analysis are those used by the U.S. Bureau of Census for the population census. These subdivisions are shown in Fig. 1.

The 1954 questionnaire reply data are summarized in Figs. 2, 3 and 4 which show the costs which were reported. These include extreme values, arithmetic averages and median values. The number of cities reporting are also shown. The New England States show the highest values for lateral sewer costs and these are closely followed by the Middle Atlantic States. Lowest costs for sewers are reported by the West South Central States.

The arithmetical average costs shown in Figs. 2, 3 and 4 are plotted on Fig. 5 as costs per inch of diameter. The national average for lateral sewers varies from 38 cents per inch diameter for 12-inch to 42 cents for 8-inch including trenching, laying and backfilling. The New England States costs are on the average about 50 percent higher than the national average and the West South Central costs about 50 percent lower—representing a total average cost range for the entire country of approximately 300 percent.

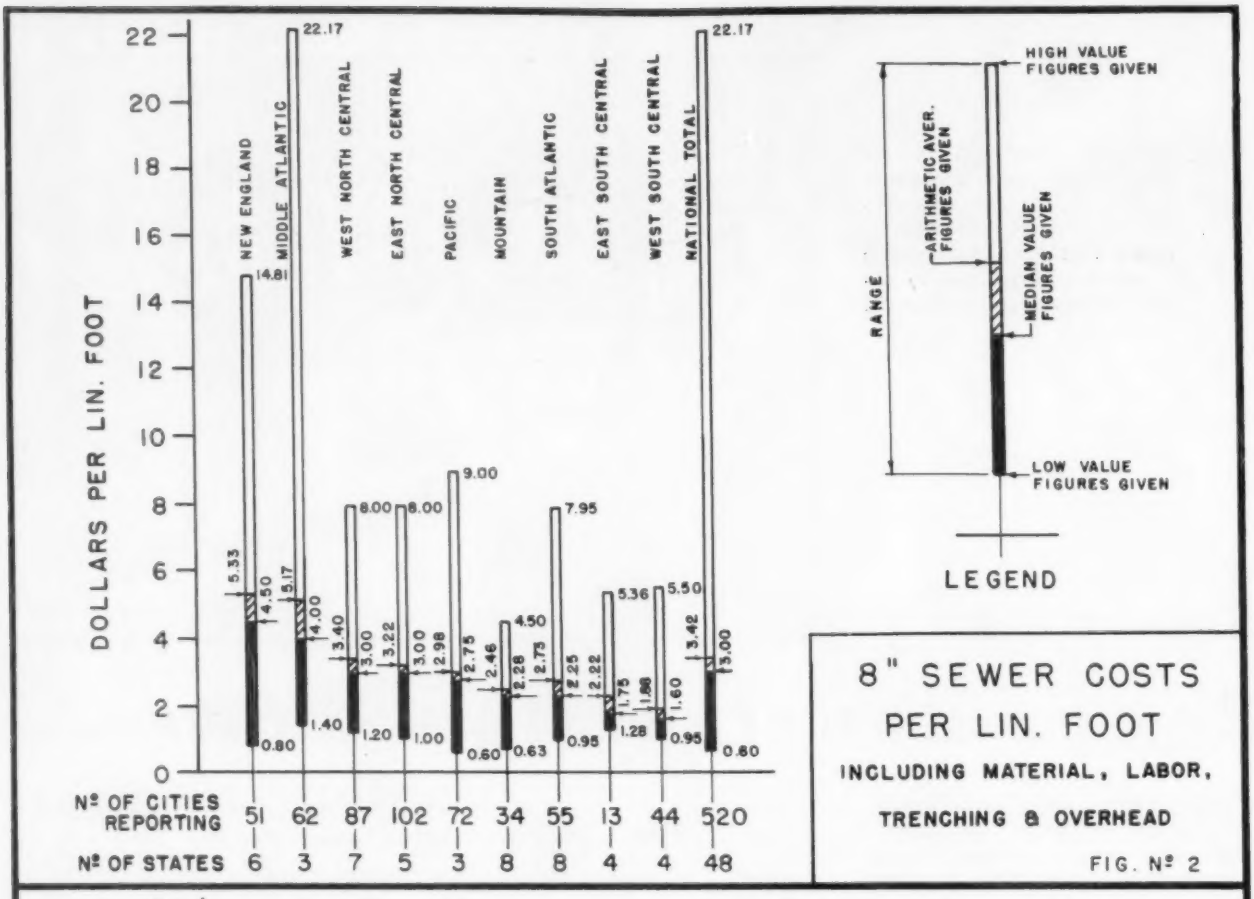
Analysis of the 1955 Data

The 1955 questionnaire was answered by 264 cities. The cost data obtained were also summarized according to geographical subdivisions. Again significant data were received only for 8-inch, 10-inch and 12-inch sizes. The unit costs have been shown graphically in Figs. 6 to 11 inclusive and in Fig. 12, a composite calculated cost for 8-inch sewer is shown.

Of the cities replying 87 percent advised that new sewer work is let out under contract. Of these about 10 percent do some sewer work with city forces such as small extensions; 13 percent of those replying indicated that all sewer work is done by city forces.

Of the cities that let out the sewer work under contract, 24 percent take bids on the basis of unit

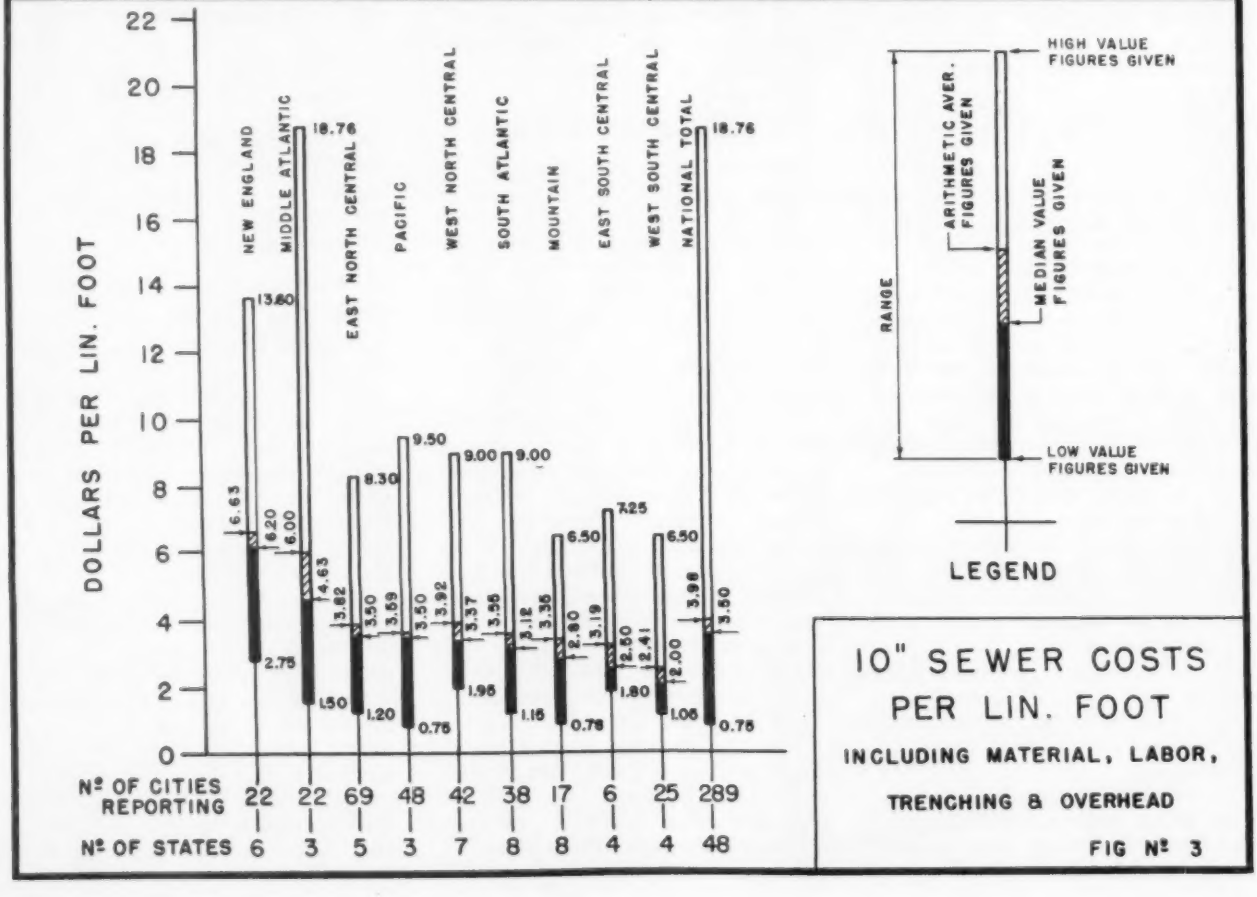
(*Please turn to page* 74)



8" SEWER COSTS PER LIN. FOOT

INCLUDING MATERIAL, LABOR, TRENCHING & OVERHEAD

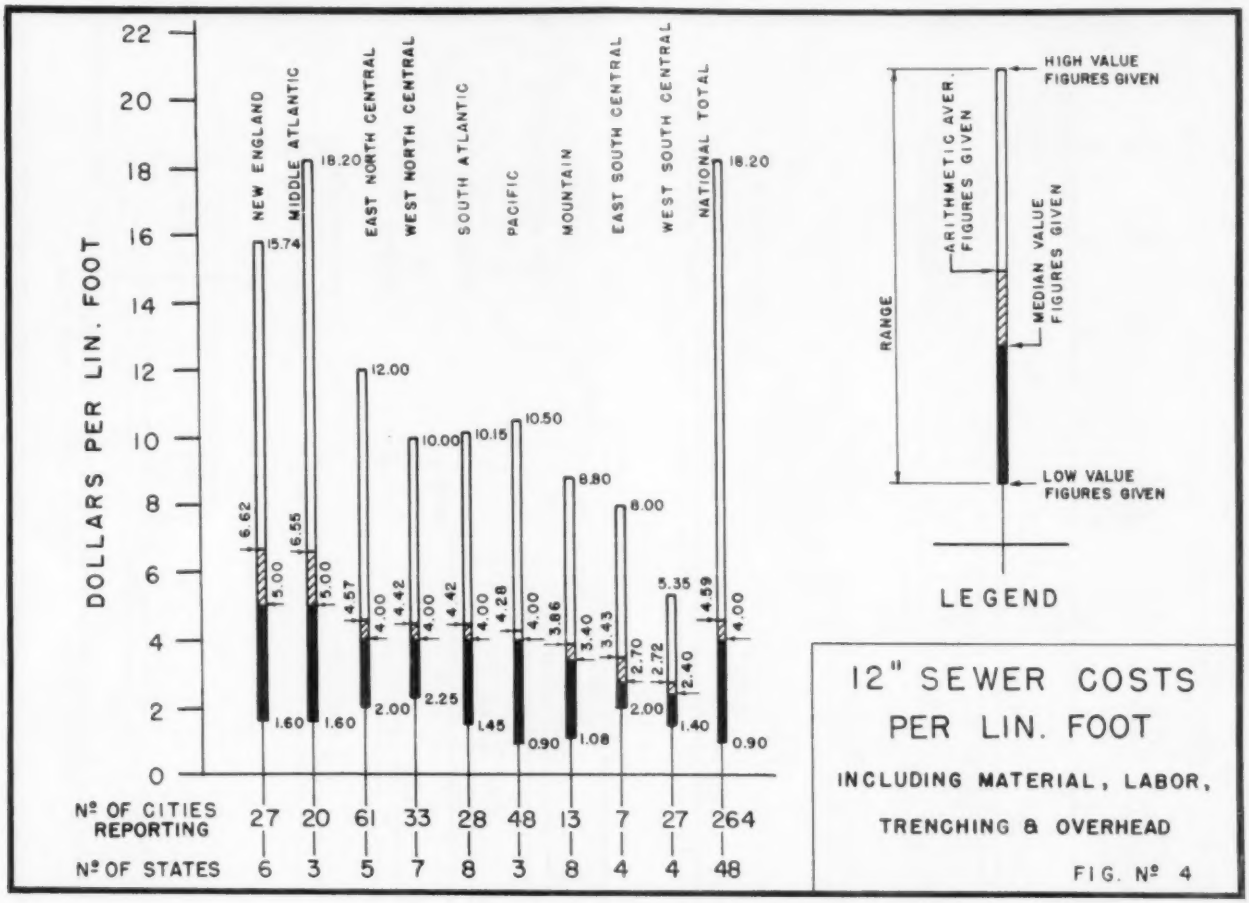
FIG. Nº 2



10" SEWER COSTS PER LIN. FOOT

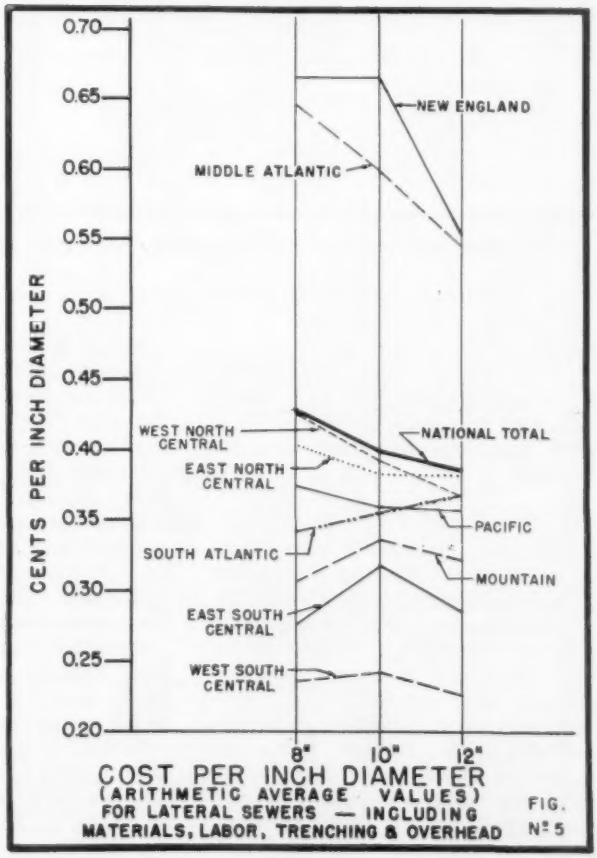
INCLUDING MATERIAL, LABOR, TRENCHING & OVERHEAD

FIG Nº 3

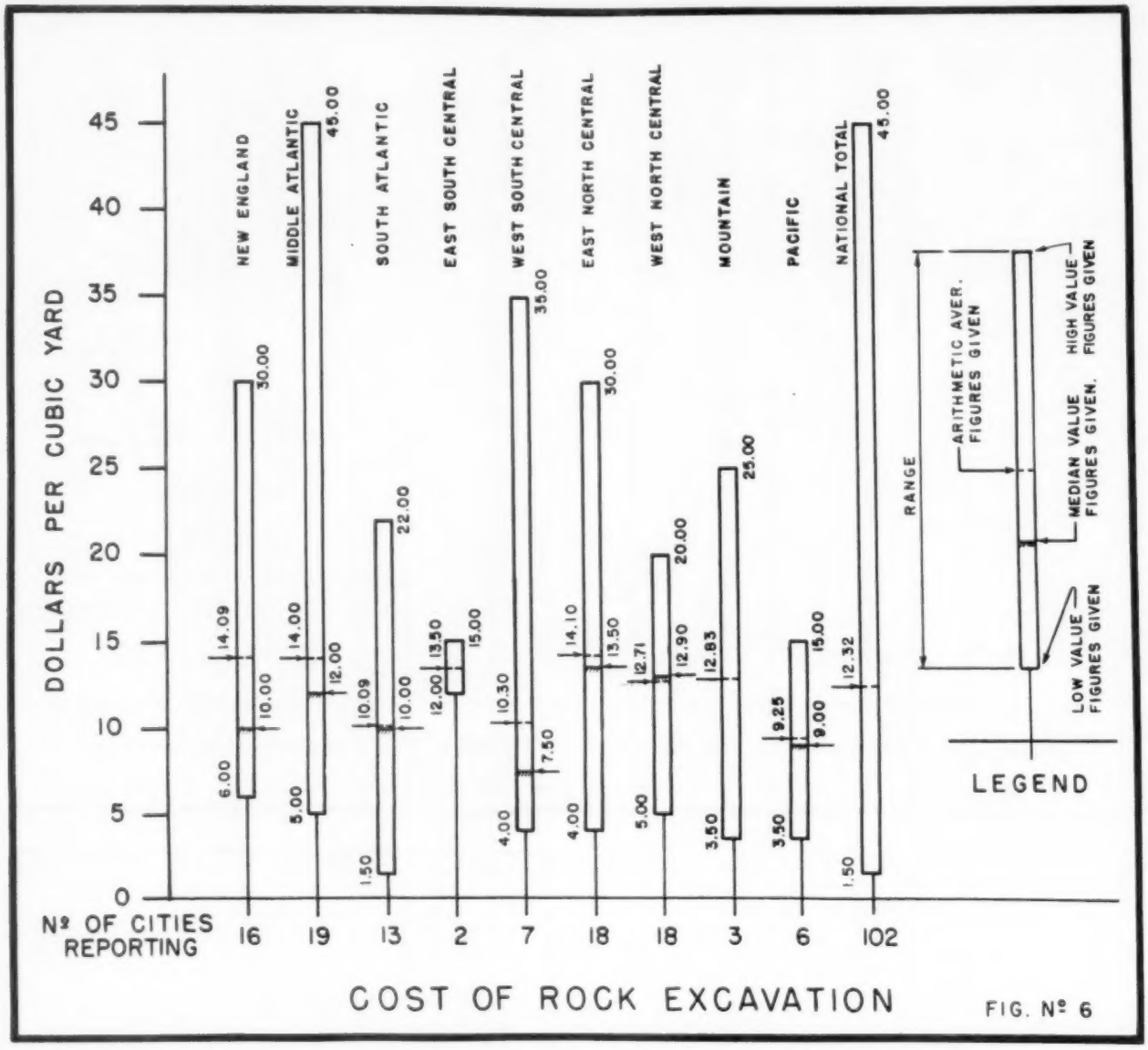


12" SEWER COSTS PER LIN. FOOT
INCLUDING MATERIAL, LABOR, TRENCHING & OVERHEAD
FIG. Nº 4

● **DATA FROM 520 CITIES** are analyzed in Figures 2, 3, 4 and 5. In these charts costs are summarized to show extreme values, arithmetic averages and median values per lineal foot of 8-inch, 10-inch and 12-inch sewer for each geographical subdivision, as indicated by the legends accompanying the figures. Extreme costs vary greatly in each area, with the greatest range appearing in the Middle Atlantic States. Arithmetical averages, plotted as cost per inch of diameter in Figure 5, reveal that costs in the New England and Middle Atlantic states are considerably higher than the national averages while costs in the South Central areas run about 50 percent lower than average costs throughout the Nation.



COST PER INCH DIAMETER
(ARITHMETIC AVERAGE VALUES)
FOR LATERAL SEWERS — INCLUDING MATERIALS, LABOR, TRENCHING & OVERHEAD
FIG. Nº 5



● **ROCK EXCAVATION costs again show the Middle Atlantic States with the greatest range from high to low values.**

prices for excavation, pipe, laying etc; 62 percent take bids on a price per lineal foot of completed sewer; 9 percent use both methods; 4 percent reported the use of lump sum type of contract; and one percent the use of force account methods.

Unit Costs

The unit costs which were reported show wide ranges depending upon local circumstances. Variation is considerable with respect to geographical location. Figs. 6 to 11 show the range of values reported, together with the arithmetic average; and where sufficient data are available, the median value is shown. In all cases, the number of cities reporting is shown. The national total figures show the national range and the national arithmetic average of the values reported.

Fig. 6 shows unit prices for rock excavation. Highest median value of $13.50 per cubic yard is found in the East North Central states and the lowest median value of $7.50 per cubic yard is found in the West South central region.

Excavation unit prices are shown in Fig. 7 and are grouped by depth from zero to eight feet, 8 to 12 feet, and over 12 feet under each geographical subdivision. The highest median values are found in the New England and Middle Atlantic States and the lower values occur in the south and the west.

In Fig. 8 is shown the combined cost of pipe and laying for 8-inch, 10-inch and 12-inch sewers exclusive of the cost of excavation and backfill.

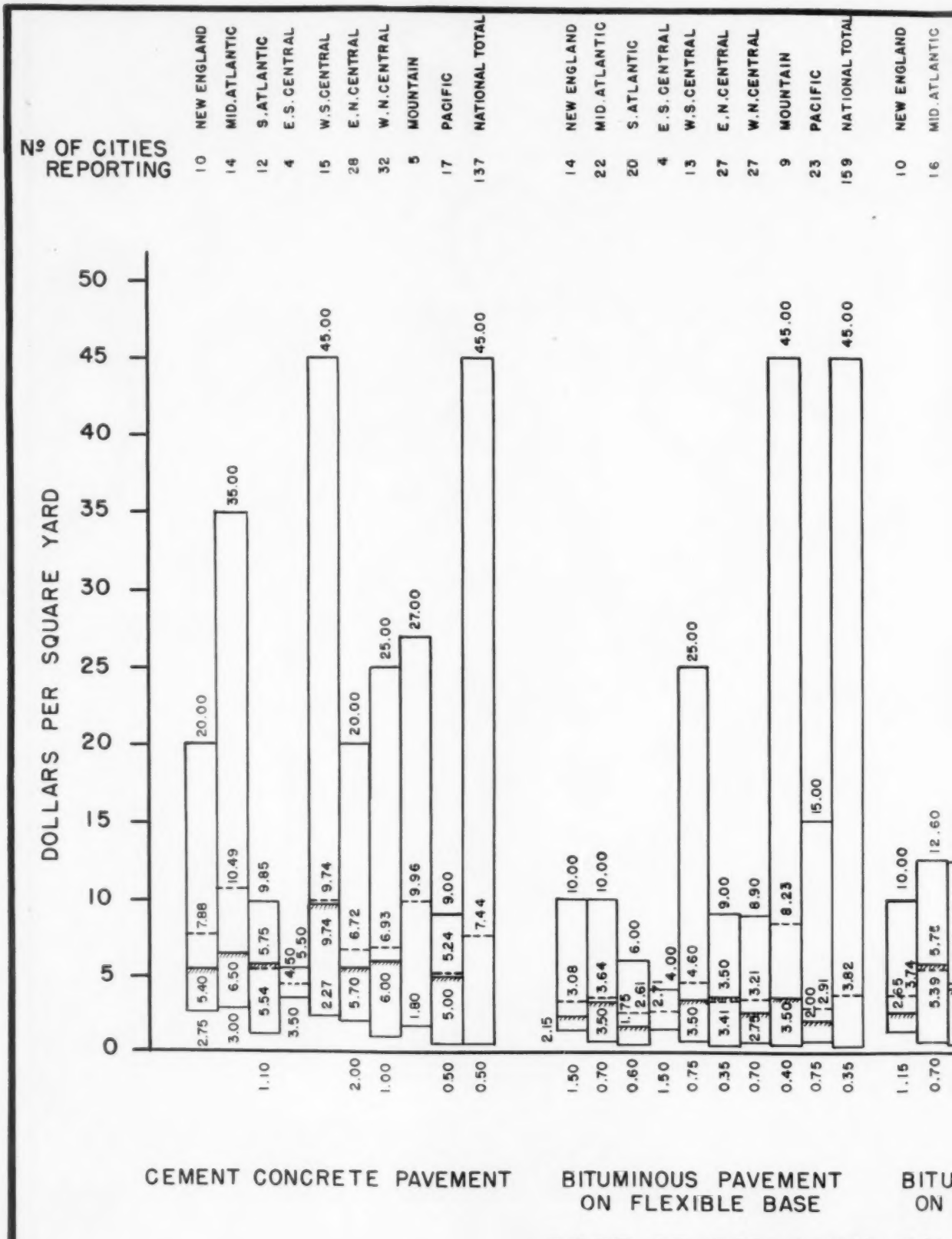
The cost per square yard for pavement replacement for cement concrete pavement, bituminous pavment on flexible base and bituminous pavement on concrete base are shown in Fig. 9. The cost of replacing lawn areas is also shown on this figure.

Fig. 10 shows cost of manholes 0 to 8 feet deep and Fig. 11 shows costs of manholes 8 to 12 feet deep. The costs of brick manholes, block manholes and concrete pipe manholes are grouped under each geographical subdivision for purposes of comparison. Of the 273 municipalities supplying cost data for manholes, 54 percent reported costs for brick manholes, 26 percent for block manholes and 20 percent for concrete pipe manholes.

The median values of the unit costs for each geographical location

EXCAVATION — UNIT PRICES
COST OF EXCAVATION & BACKFILL
DOLLARS PER CUBIC YARD
DEPTH
LOW VALUES
Nº OF CITIES REPORTING
0 TO 8'
8' TO 12'
OVER 12'
NEW ENGLAND
MIDDLE ATLANTIC
SOUTH ATLANTIC
EAST CENTRAL
WEST SOUTH CENTRAL
EAST NORTH CENTRAL
WEST NORTH CENTRAL
MOUNTAIN
PACIFIC
NATIONAL TOTAL
LEGEND
0 TO 8'
8' TO 12'
OVER 12'
MEDIAN VALUE
HIGH VALUE
ARITHMETIC AVERAGE
RANGE
LOW VALUE

FIG. Nº 7

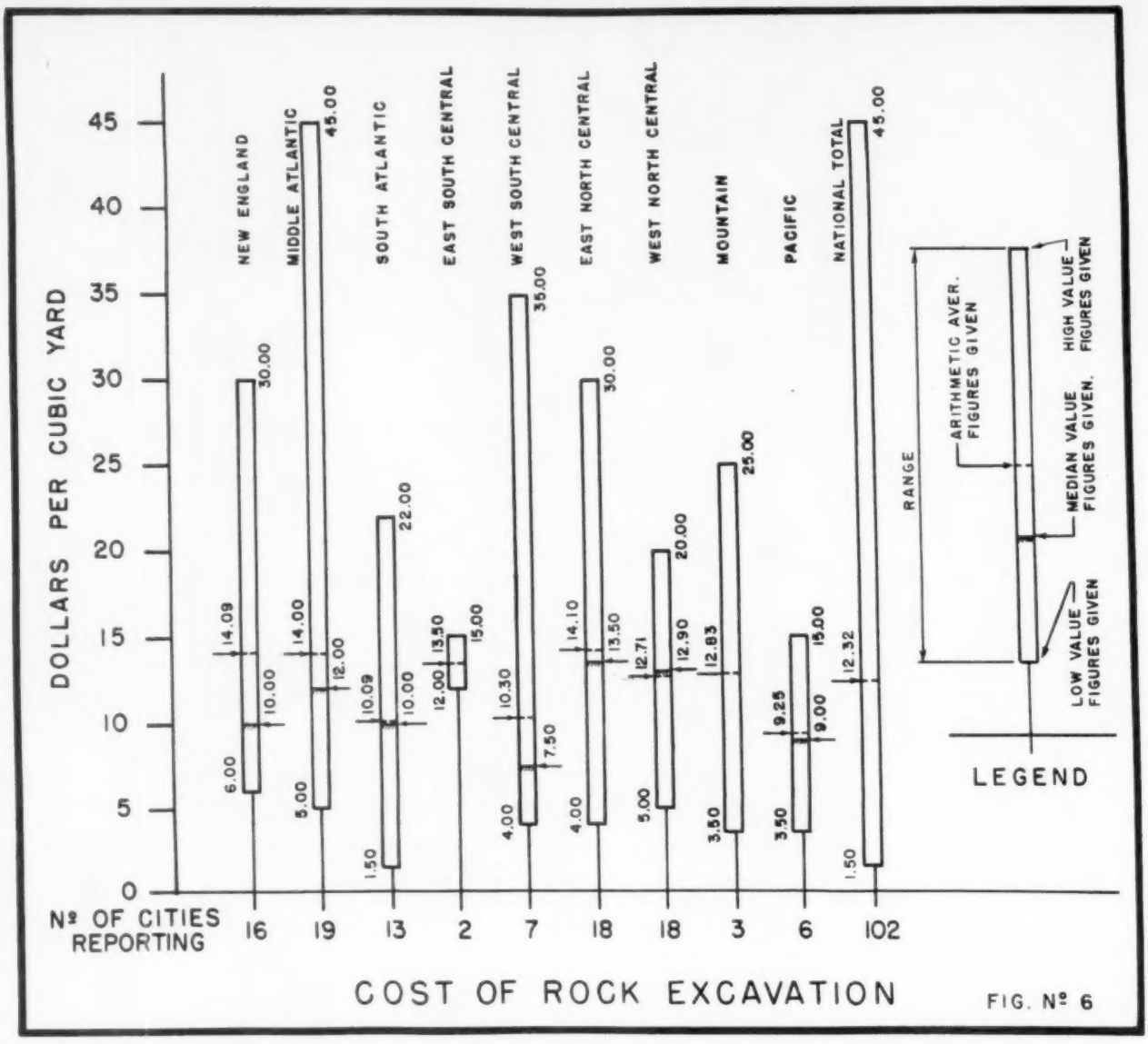

Nº OF CITIES REPORTING
DOLLARS PER SQUARE YARD
0
5
10
15
20
25
30
35
40
45
50
10 NEW ENGLAND
14 MID.ATLANTIC
12 S.ATLANTIC
4 E.S.CENTRAL
15 W.S.CENTRAL
28 E.N.CENTRAL
32 W.N.CENTRAL
5 MOUNTAIN
17 PACIFIC
137 NATIONAL TOTAL
2.75 5.40 17.88 20.00
3.00 6.50 10.49 35.00
1.10 5.54 5.75 9.85
3.50 4.50 5.50
2.00 2.27 9.74 9.74 45.00
1.00 5.70 6.72 20.00
0.50 6.00 6.93 25.00
0.50 1.80 9.96 27.00
5.00 5.24 9.00 45.00
7.44
14 NEW ENGLAND
22 MID.ATLANTIC
20 S.ATLANTIC
4 E.S.CENTRAL
13 W.S.CENTRAL
27 E.N.CENTRAL
27 W.N.CENTRAL
9 MOUNTAIN
23 PACIFIC
159 NATIONAL TOTAL
2.15 3.08 10.00
1.50 3.50 3.64 10.00
0.70 1.75 2.61 6.00
0.60 2.71 4.00
1.50 3.50 4.60 25.00
0.75 3.41 3.50 9.00
0.35 2.75 3.21 8.90
0.70 3.50 8.23 45.00
0.40 2.00 2.91 15.00
0.75 3.82 45.00
0.35
10 NEW ENGLAND
16 MID.ATLANTIC
1.15 2.65 3.74 10.00
0.70 5.39 5.75 12.60
CEMENT CONCRETE PAVEMENT
BITUMINOUS PAVEMENT ON FLEXIBLE BASE
BITU ON
COST OF REPLACING PAV

ITUMINOUS PAVEMENT
ON CONCRETE BASE

LAWN AREAS

AVEMENTS & LAWN AREAS

FIG. Nº 9



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The median values of the unit costs for each geographical location

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COST OF EXCAVATION & BACKFILL
DOLLARS PER CUBIC YARD
Nº OF CITIES REPORTING
LOW VALUES
DEPTH
0 TO 8'
8' TO 12'
OVER 12'
LEGEND
HIGH VALUE
MEDIAN VALUE
ARITHMETIC AVERAGE
RANGE
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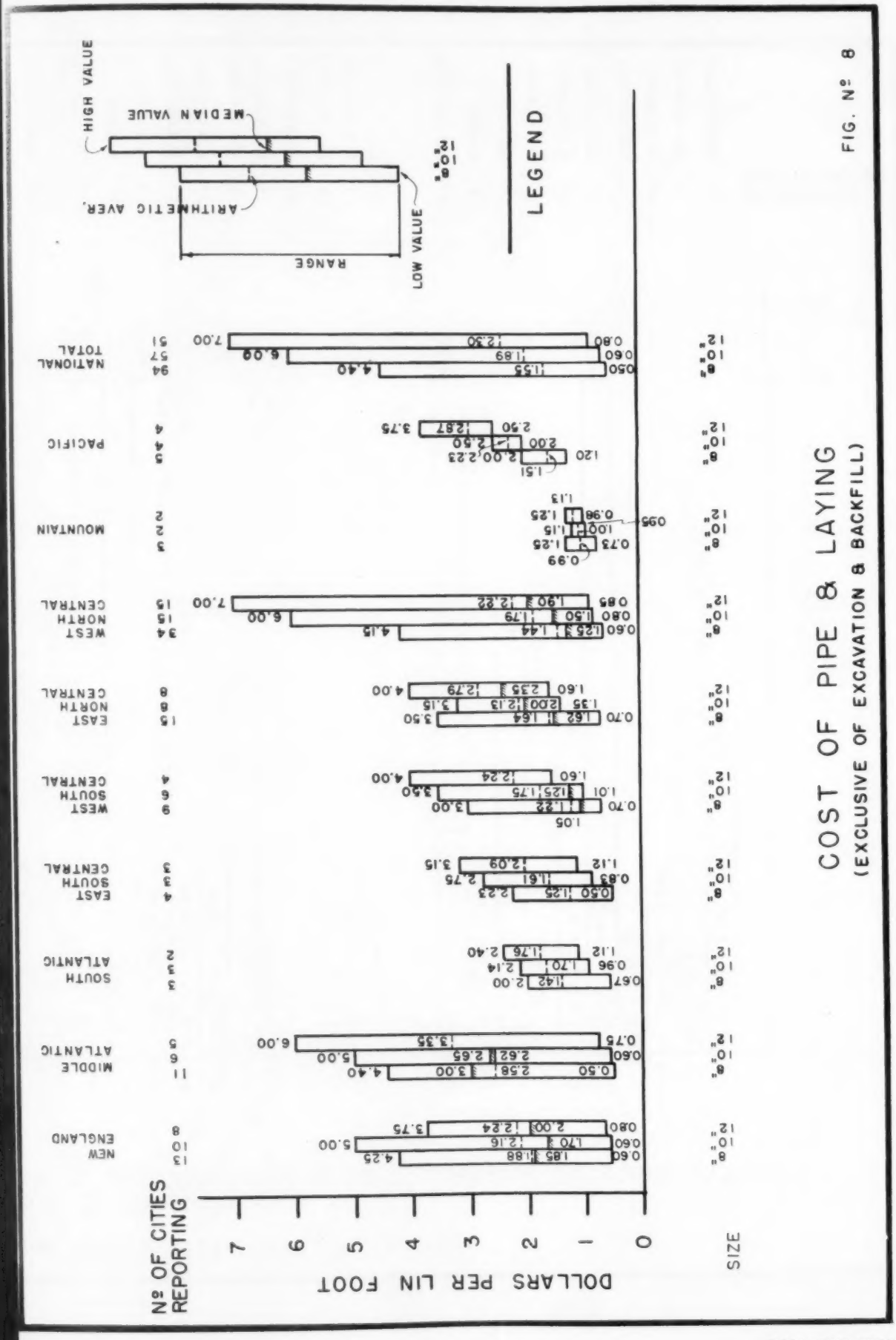
NEW ENGLAND
MIDDLE ATLANTIC
SOUTH ATLANTIC
EAST CENTRAL
WEST SOUTH CENTRAL
EAST NORTH CENTRAL
WEST NORTH CENTRAL
MOUNTAIN
PACIFIC
NATIONAL TOTAL

FIG. Nº 7



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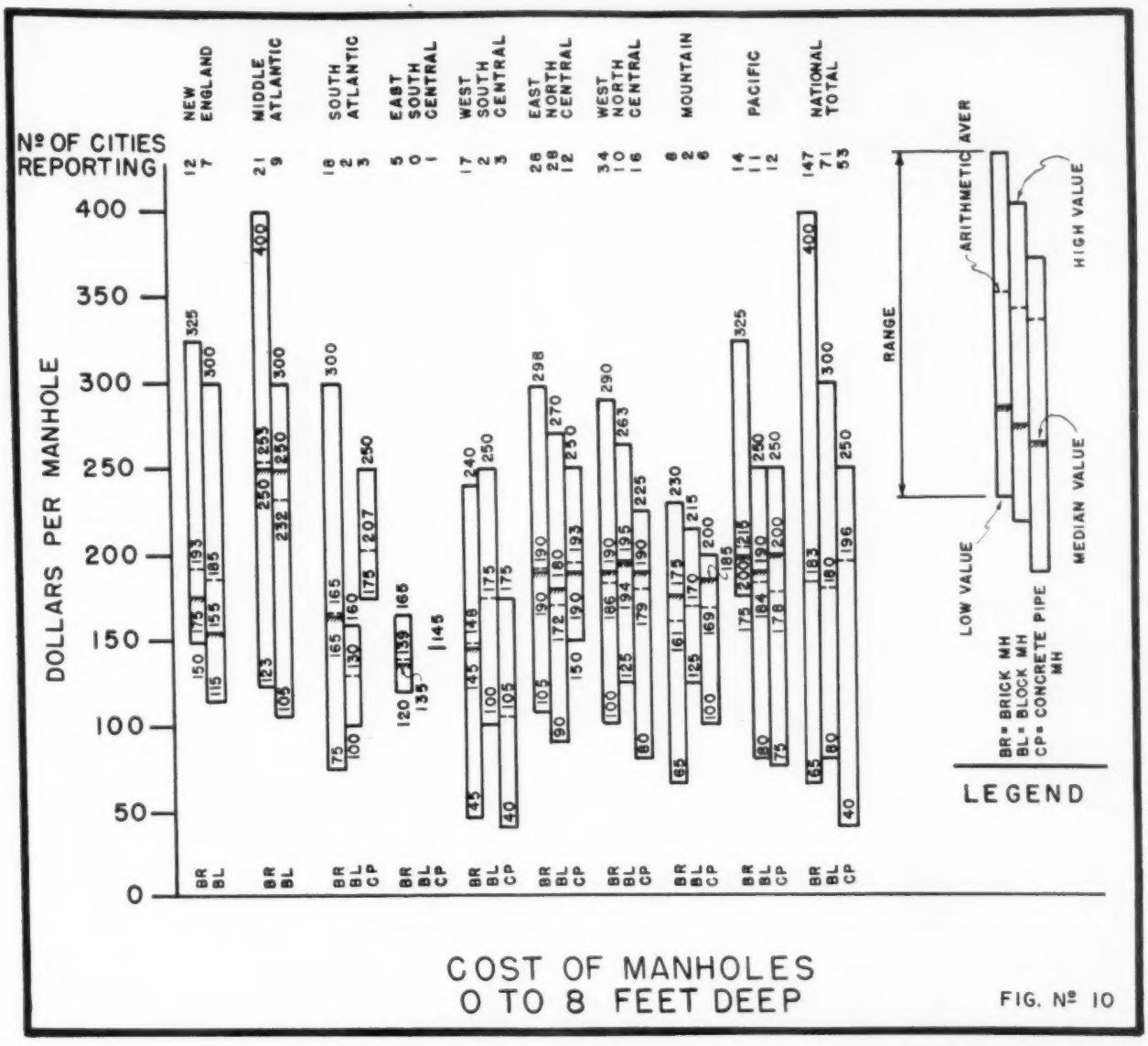

COST OF MANHOLES
0 TO 8 FEET DEEP

FIG. Nº 10

● **MANHOLE CONSTRUCTION** cost data show prices paid for brick, block and concrete pipe manholes up to 8 ft. deep.

were used to compute the hypothetical cost for 8-inch sewer shown in Fig. 12. The trench width was taken as 2 feet 8 inches and the depth of excavation as 8 feet. Manholes were taken as being spaced on 350-foot centers and the 8-foot deep manhole prices were used to allocate the manhole cost over 350 feet of sewer. The width for pavement replacement was taken as 2 feet 8 inches and prices for bituminous pavement on flexible base were used.

Calculated Cost

The figures calculated for the national average comprise the arithmetic averages of all reported costs. The costs calculated for each geographical subdivision represent the application of median prices for each location. On the basis of the national average figures and using 66 cents per foot as the delivered cost of 8-inch pipe, the following percentages are evolved for the components of sewer cost: Excavation 27.8; pipe 14.8; laying 20.0; manholes 11.6; and pavement 25.8 percent.

As is evident from Fig. 12, the component percentages vary in amount with geographical location. Laying costs appear to be high in the New England and Middle Atlantic areas and might most probably be ascribed to the high cost of labor in these areas.

On the basis of Fig. 12, the average national cost for 8-inch sewer is $23,500 per mile with a median range from $15,900 in the mountain states to $35,600 per mile in the Middle Atlantic States. The costs for 10-inch and 12-inch sizes were similarly computed from the reported costs using an 8-foot depth, diameter plus 2 feet for trench width, 350-foot manhole spacing and bituminous pavement on flexible base. The cost range per foot (median values) and the cost per mile, based on a national arithmetic average, for 8, 10 and 12-in. sewers are: 8-in., $3.01 to $6.94 per foot and $23,500 per mile; 10-in., $3.09 to $6.55 per foot and $26,000 per mile; 10-in., $3.32 to $7.44 per foot or $28,900 per mile.

Soils, Ground Water and Crews

It is of interest that 188 cities reported materials encountered in sewer excavations. Of these 81 percent reported some type of clay; 7 percent sand; and the remainder shale, hardpan, or rock. No definite correlation between soil materials

COST OF REPLACING PAVEM
CEMENT CONCRETE PAVEMENT
BITUMINOUS PAVEMENT ON FLEXIBLE BASE
BITUMINO ON CONC
DOLLARS PER SQUARE YARD
0
5
10
15
20
25
30
35
40
45
50
Nº OF CITIES REPORTING
10 NEW ENGLAND
14 MID.ATLANTIC
12 S.ATLANTIC
4 E.S.CENTRAL
15 W.S.CENTRAL
28 E.N.CENTRAL
32 W.N.CENTRAL
5 MOUNTAIN
17 PACIFIC
137 NATIONAL TOTAL
14 NEW ENGLAND
22 MID.ATLANTIC
20 S.ATLANTIC
4 E.S.CENTRAL
13 W.S.CENTRAL
27 E.N.CENTRAL
27 W.N.CENTRAL
9 MOUNTAIN
23 PACIFIC
159 NATIONAL TOTAL
10 NEW ENGLAND
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11 S.ATLANTIC
3 E.S.CENTRAL
2.75 5.40 7.88 20.00
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1.10
3.50 4.50 5.50
2.27 9.74 9.74 45.00
5.70 6.72 20.00
2.00
6.00 6.93 25.00
1.00
1.80 9.96 27.00
5.00 5.24 9.00
0.50
5.00 7.44 45.00
0.50
2.15 3.08 10.00
1.50
3.50 3.64 10.00
0.70
1.75 2.61 6.00
0.60
2.71 4.00
1.50
3.50 4.60 25.00
0.75
3.41 3.50 9.00
0.35
2.75 3.21 8.90
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3.50 8.23 45.00
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2.00 2.91 15.00
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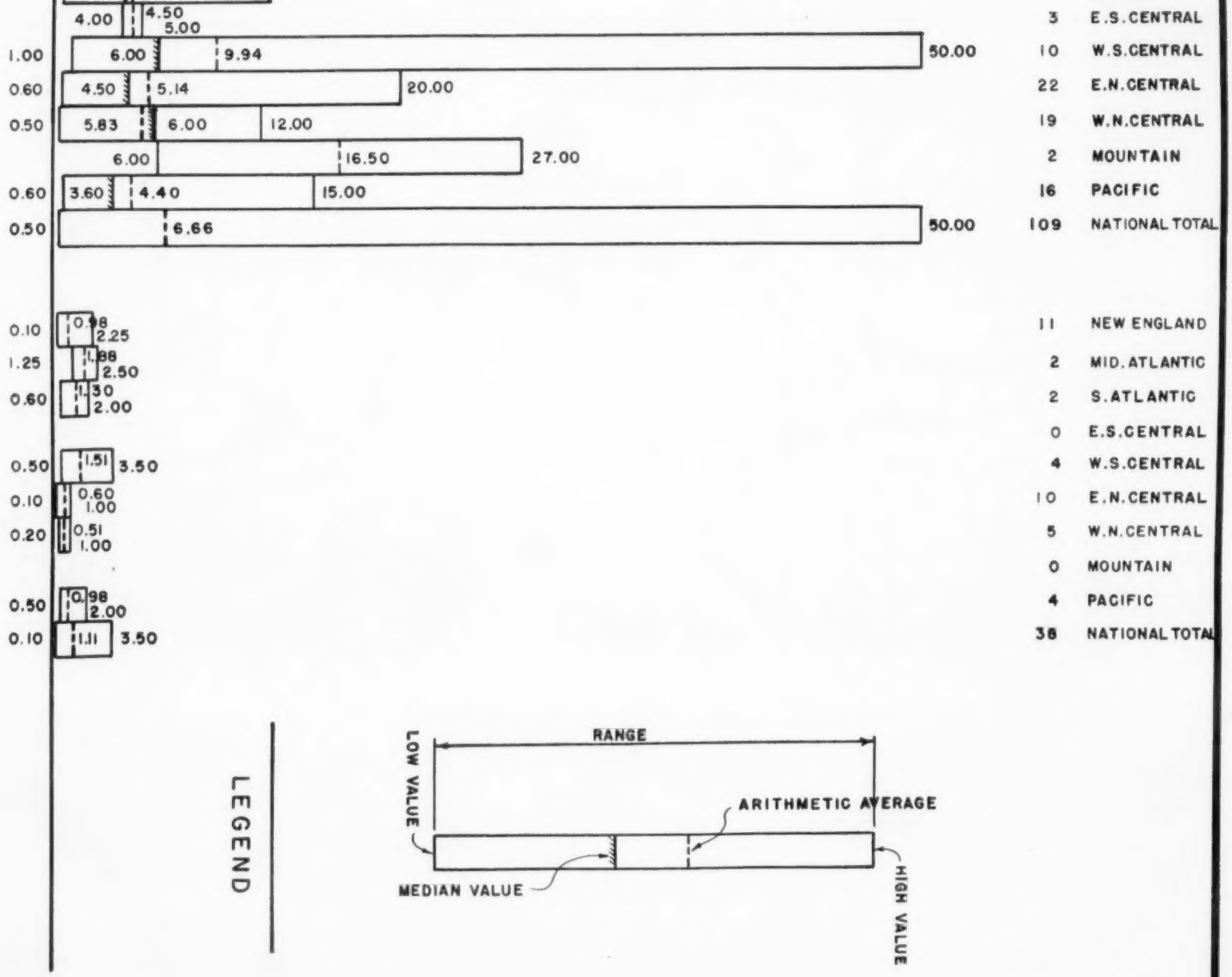
2.65 3.74 10.00
1.15
5.39 5.75 12.60
0.70
4.25 4.54 12.40
0.60
4.00 4.50 5.00

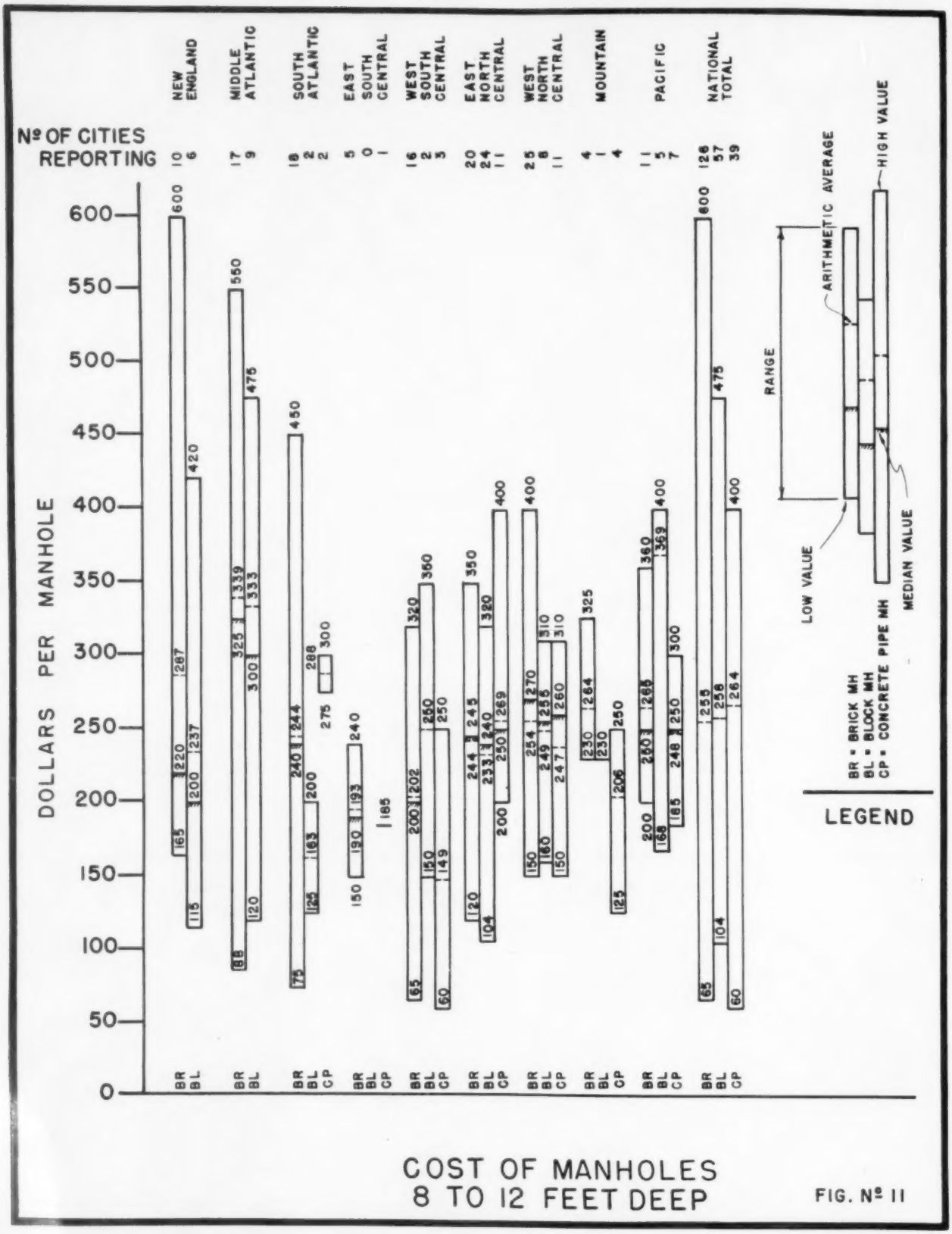


BITUMINOUS PAVEMENT
CONCRETE BASE

LAWN AREAS

PAVEMENTS & LAWN AREAS

FIG. Nº 9

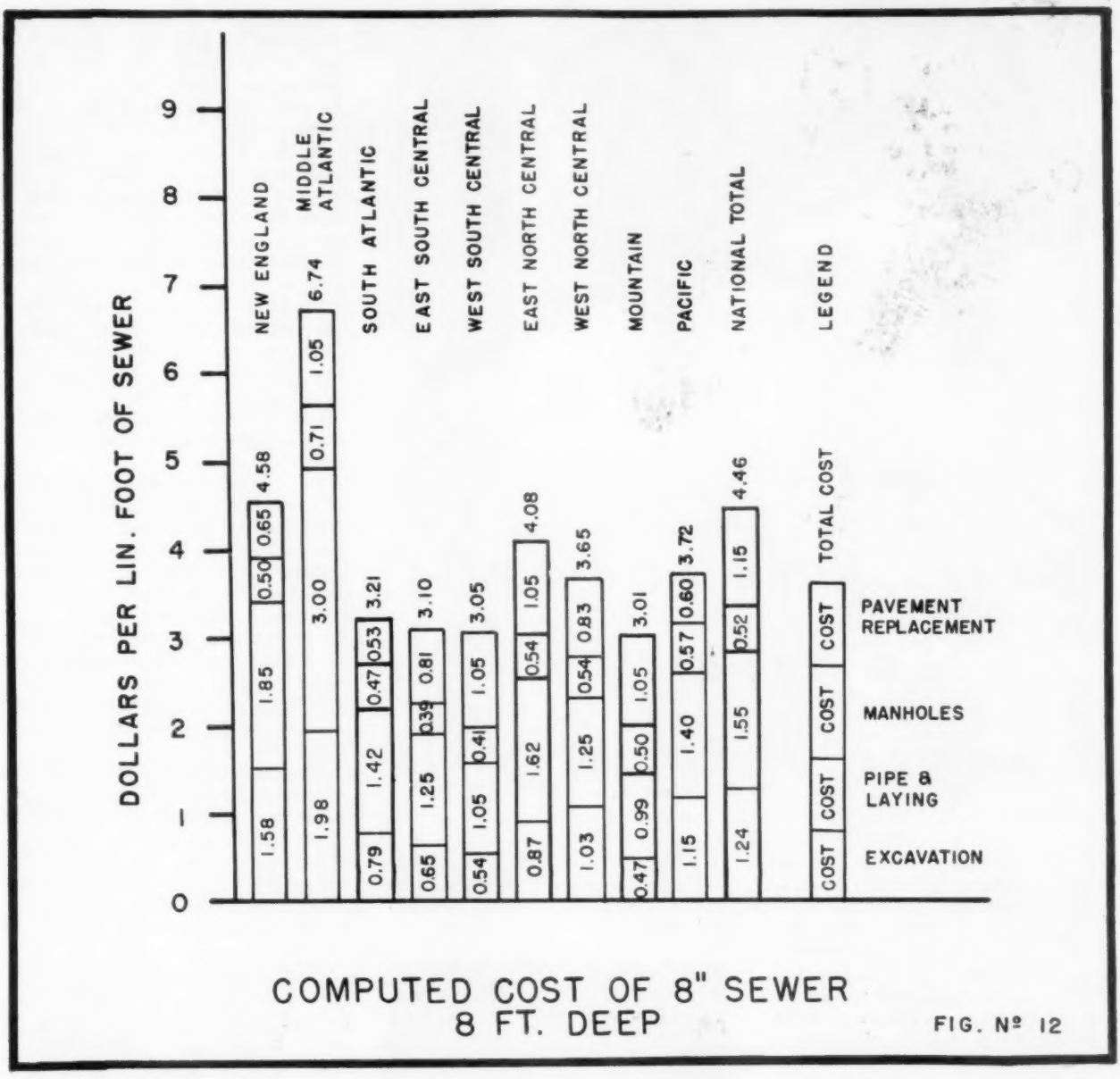


COST OF MANHOLES
8 TO 12 FEET DEEP

FIG. Nº 11

● **COSTS OF MANHOLES** were reported by 273 municipalities. It is interesting to note that the data presented above show only a small variation in cost for brick, block and concrete pipe construction when analyzed as a national average.

● **COMPUTED UNIT COSTS** for an 8-inch sewer, 8 feet deep, shown in Figure 12 on the opposite page, assumes that the trench width is 2 feet 8 inches; manholes spaced on 350-foot centers and pavement replaced with bituminous materials.



COMPUTED COST OF 8" SEWER
8 FT. DEEP

FIG. Nº 12

and prices could be found. Of the 188 cities, 31 percent reported encountering ground water in sewer excavations; 12 cities gave prices for well points usage which varied from $1 to $10 per foot of trench. In general, prices were higher where ground water was encountered, but no definite correlation with prices could be found. In a few cases it was stated that wet conditions cost twice as much per foot compared with dry conditions.

The data reported for the number of men in the sewer-laying crews were inconclusive in that variations were reported all the way from 2 to 27 men. The most frequent number for the 138 cities answering this question was 6; but in the Pacific States it was 10; in the South Atlantic 8; in New England and the West South Central 7; elsewhere it was 6, except in the Middle Atlantic States where it was 5. It is believed that much depends on the size of the job and on the soil conditions. For instance, a job too small for trenching equipment might use extra men; or if soil conditions were unsuitable for trenching equipment, more men also would be used.

For the cities not doing their own work the number of men per crew reported was that used by contractors engaged in work for the city. In a few cases, it was stated that crews numbering over 20 men were used for large sewers. The typical 6-man crew comprises one trenching machine operator, one bulldozer operator, two pipe men, and two truck drivers.

The most commonly used equipment reported for one crew illustrates the variety of useful equipment employed in sewer construction. The list included backhoe or trenching machine, a bulldozer or end loader, compressor, pumps and dump trucks. Other equipment reported included graders, air drills, mechanical tampers, shovel-dozer, concrete mixers, pick-up trucks, crane, roller, hoist, drag line, clam shell and well points, together with small hand tools.

Acknowledgement — The writer wishes to express his appreciation for the cooperation of Colonel Hardenbergh, Editor of PUBLIC WORKS MAGAZINE, and his indebtedness to Richard Pierce of the writer's office for his aid in tabulating the data and preparing the plates.

WELDING
Saves Time and Cost on Repair of Ornamental Lamp Posts

COST OF keeping the 177 cast iron lampposts in use in Forest Hills Gardens, a private residential section of Forest Hills, New York, was running prohibitively high—$5,000 to $7,000 a year—until Patrick O'Brien, superintendent of the district's maintenance crew, worked out a method of repairing the posts. Mr. O'Brien estimates that from 50 to 75 of the lampposts have been knocked down by careless motorists since the new system went into use.

Replacing the broken posts with new units would have run somewhere between $15,000 and $20,000 including labor. However, a welding team from General Welding Service, Elmhurst, Long Island, using portable equipment, has been welding the poles on the spot with Ni-Rod "55", a nickel-iron welding electrode developed especially for cast iron welding. With this system, cost of repairing posts has been ranging between $30 and $35 each, depending on the amount of damage.

The complete lamppost unit consists of a base below ground, a baseplate for the pole to rest on, the pole itself, and a glass enclosed "birdcage" that houses the light. All metal parts are cast iron and at one time or another, all of these parts on some poles have been smashed and welded.

Many times when a post is toppled over the cast iron cage shatters and has to be rebuilt. In such cases, the welder merely lays the post on its side, repairs the birdcage, and reattaches it to the post.

To assure speedy repair of broken posts that present a hazard to traffic and children in the neighborhood, Mr. O'Brien has worked out a plan for quick action with the aid of the welders. As soon as a broken pole is reported by a resident, or discovered by the Corporation's maintenance crew, Mr. O'Brien checks to see that the wires inside the pole are intact, then stations a guard at the site and calls in the welders. Usually the broken lamppost is operating in a matter of hours.

The repair procedure is simple. The welder first grinds the rough surface of the break with an abrasive wheel. Then he puts the iron post in position and welds it with the proper size welding rod. Most of the work requires a $\frac{1}{8}$-inch electrode. Only if there is a substantial amount of rebuilding to be done does the welder use a larger diameter rod. The finished nickel-iron welds are smooth. No grinding is necessary to complete the job.

To complete the job, Mr. O'Brien's crew puts on a fresh coat of green paint and the pole is as good as new. It can be repaired as many times as necessary but no pole has even broken at the weld—although some have been broken and repaired as many as four times.

● **WELDED repair has been made to damaged cast iron ornamental standard.**

● **BIRD-CAGE with lamp. Note repair where upper bracket is attached to post.**

STANDARDIZED BRIDGES
Bring Better Bids

WILLIAM A. STANCER

Engineer, Pierce Co., Washington

● **PRE-CAST** concrete plank deck is shown here on a bridge having a treated timber superstructure. This type of deck replaced timber flooring formerly in service.

REPLACEMENT of obsolete structures on our County road system has proved to be one of the most difficult phases of our work. The difficulty, of course, stems from increased vehicle registration and greatly increased vehicle mileage without a corresponding increase in money for highways. The County has attempted to get the voters to authorize bond issues that would permit the replacement of some of these old structures, but the voters have consistently turned down such propositions, and it has been necessary for the County Engineer to find means for this heavy replacement program from existing funds. Meanwhile, he has had to improve and maintain the existing road net. To devise a plan that would meet these needs required analysis of the practices that have been followed in maintaining and improving the system. This analysis proved that the County cannot afford to attempt the replacement of these structures, either large or small, with its own forces.

A study of the funds available for bridge work showed that it would be necessary to eliminate all of the jewelry from the structures, and that several different types of construction would be needed to permit the economical replacement of the existing bridges. It was recognized that permanent type structures should be built, looking to future needs for not less than a 25-year period.

It was determined that, to secure better bids from contractors, alternates should be provided for, in most instances, in the plans; also, to encourage more of the small contractors to bid, the structures should be so designed as to permit maximum use of equipment that could be rented and was available in the area. It was further recognized that in many instances, to encourage the smaller contractors, it would be necessary to "lead him by the hand." This required the assignment of capable engineering help as field engineers on those jobs.

Because of the inadequacy of the road net in some areas and the consequent lack of suitable detour routes, plans had to provide for the shortest possible closure time of the roads affected. Precasting of units seemed to give the greater promise toward this end; however, alternates were provided which would permit the bidder, if he so desired, to cast the members in place.

Working with Contractors

Our contractors were kept fully advised of the plans that were being developed under this program. Precasting was set up so that it might be done completely on some structures, and on some structures partially. Maximum use was made of concrete for the decking, the substructure and the piling. In some instances backwalls were precast and hung or attached to concrete piling. Decks were precast in sections referred to as "U" sections or as concrete planks. Curbs were precast and bolted down to the deck sections. Rail posts were precast and maximum use was made of flexbeam guard rail for bridge railing.

Designs on some structures provided for pouring-in-place of the abutments, precasting of the beams, and pouring-in-place of the deck, again utilizing precast concrete posts and flex-beam guard rail. Some existing structures, with treated timber piling, treated timber caps and treated stringers, were found to be in such shape that they would support concrete decks, either precast or poured-in-place; and on these bridges that procedure was followed.

In the design of all of these structures, the matter of cost to the County was carefully estimated; and even where alternates were provided, both the preferred and the alternate were carefully analyzed, and bids awarded on the basis of minimum closure and minimum cost per square foot.

This program, in a very short period of time, provided us with a group of extremely efficient contractors, many of whom might be classed as smaller contractors. It opened a new field for them that has

proved profitable. It also provided structures that might be classed as "packaged" units. It was found that the same type of basic unit could fit into several different types of structures and forms could be built that were usable on several different projects. County plans for the forms were made available to any of the contractors who desired to use them. However, the contractors were permitted to design their own forms if they so desired. Tolerances were kept extremely close.

Under this type of planning, it has been possible for the County to replace some 60 of our inadequate bridges in the past four years without the use of any additional or special funds.

Contracting by Governmental units will provide greater returns from the moneys expended. This procedure must be combined with competent engineering, good supervision and long range realistic planning if the funds available are to provide the services demanded by present and future increased traffic.

The easiest way to meet these problems of growth is to request additional funds. In many cases this is the most desirable way; but more funds are not going to be made available indefinitely; there will no doubt be more money from gas taxes and other sources, but the funds do not increase to the same extent and in the same ratio as vehicle use and the resulting demands for increased facilities and service.

Trying to maintain inadequate and poorly designed roads and bridges so they can serve modern traffic needs depletes road funds to an alarming extent. Also the critical conditions of some of these roads and bridges require the placing of unrealistic load limits on bridges, and the denial of use of roads by certain classes of vehicles legally licensed to operate over such roads for which they have been taxed and which they have the right to expect to use.

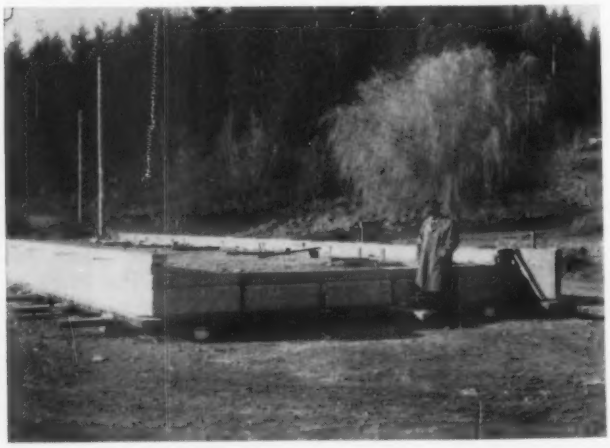
The answer I am convinced is better planning, and more permanent types of construction.

Planning does not consist merely of laying out a road net to provide for greater service to a greater number; it must also consider the matter of maintenance after construction. We cannot continue to spend a greater amount of our road funds for maintenance than we do for construction and improvements.

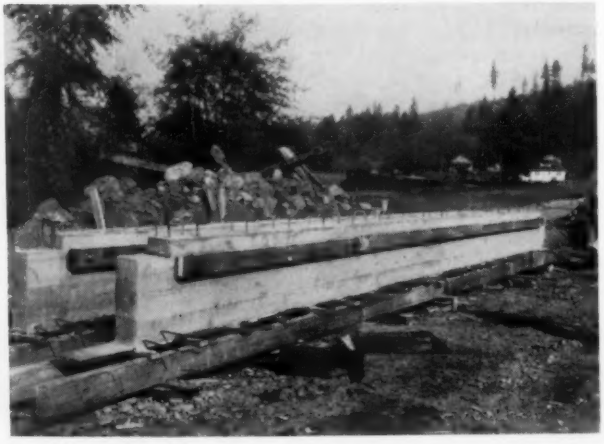
Getting a better understanding of these problems by non-technical public officials, who may control and allocate these funds, is the most difficult problem faced by the engineer. If, and when, these officials, and the citizens who elect them, understand that the qualified engineer—if his advice is followed—will provide more for their tax moneys, a new era will have arrived. We will then be in a position to provide the facilities that the vehicle user has the right to expect at the least possible cost consistent with adequate design.

● **CONTRACTOR** is placing a pre-cast beam on the abutments of a bridge. Program was based on use of contractors.

● **THESE** are beams that have been pre-cast for a poured-in-place deck; note supports for form work for the deck.



● **EACH** of these 15 pre-cast "U" sections is 4 ft. wide, 20 ft. long; all were cast at one time and at the job site.



● **ONE OF** the beams in the picture above, showing the ledger members used for supporting form work for the deck.

7 Methods of Iron Removal

H. R. FOSNOT

Graver Water Conditioning Co.,
New York City

IRON is one of the most valuable elements known to man. Unfortunately, however, iron often creates difficulties, and one such difficulty is its occurrence in water supplies. By the passage of the water through underground formations, insoluble oxides of iron are converted to a soluble form and become dissolved in the water.

Forms of iron are normally found in water as: (1) Ferrous sulfates in rivers, lakes or reservoirs containing acid wastes; or in ground waters containing sulphur, particularly if hydrogen sulfide is present. (2) Ferrous carbonates in ground waters when high amounts of free CO2 are present. (3) A complex combination of organic matter and iron, commonly referred to as organically bound iron and found in surface or ground supplies.

Water containing iron in amounts greater than 0.3 to 0.5 ppm is usually objectionable for industrial and municipal use. Some of the reasons for these objections are:

When iron in the ferrous state is brought into contact with air it combines with oxygen to form ferric oxides which impart a yellow or reddish cast to the water. This oxide causes staining of sinks, cooking utensils, chinaware, and glassware. Use of such water will develop yellow stains in clothes and textile products and handicap quality control in tanning, dyeing, and laundering plants. For example, in the tanning industry iron reacts with tanning to form undesirable iron tannate. Decaying of iron bacteria often found in waters of high iron content will result in objectionable tastes and odors. This bacterial growth may also clog filters and water meters and forms slime growths in water mains and service lines. Water with high iron content coats the interior of pipes with iron deposits increasing frictional resistance within the pipes.

The United States Public Health Service specifies that iron and manganese together must not exceed 0.3 ppm. Some states with even more stringent standards limit the iron content alone to 0.2 ppm. When these limits or industrial requirement limits are exceeded one or more of the several different methods of iron removal must be employed.

Methods of Removal

Because of the many variable factors involved, no single method of iron removal is applicable to all situations. An individual approach is necessary to effect the most complete and economical removal desired. To begin with, a reliable analysis of the water must be made to determine the amount of iron present and the form in which it occurs. The presence of any organic matter tending to bind the iron must also be investigated. Next, it must be determined if softening of the supply is desired along with iron removal so that softening equipment can be installed simultaneously. Finally, State Health Department standards should be consulted to determine the maximum iron content permissible. Since occasional state sanitary engineers will not approve some of the removal methods that are used successfully in other states, it is also wise to check individual state preferences.

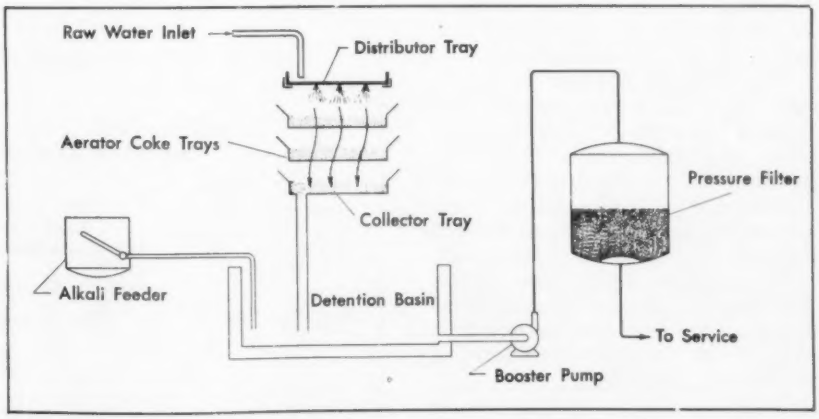
Basically, the various methods of iron removal can be grouped under three headings. The seven systems discussed here fall into one of these three categories or combine variations of two or more of them. The methods are: (1) Aeration; (2) precipitation plus solids-contact; and (3) Zeolite softening.

Aeration—Iron removal by aeration is accomplished by intimately mixing the water with air in some manner. The oxygen in the air hydrolyzes the ferrous compounds which are then precipitated as ferric hydroxide. The heavier precipitates thus formed readily settle out of solution while the lighter ones are later removed by filtration. At the same time the aeration process will reduce corrosive CO_2 and liberate unpleasant smelling H_2S. The quantity of oxygen necessary for oxidation of iron is relatively small—theoretically about 0.14 ppm for 1 ppm of iron.

Aeration for iron removal is used most effectively in conjunction with other methods since aeration alone is not completely satisfactory. When used preceding lime treatment, aeration will substantially reduce the quantity of chemicals required.

Open Coke-Tray Aeration is the most commonly used method ot iron removal. The unit consists of two or more perforated wooden trays arranged one over the other, each containing coke to a depth of 9 inches. Beneath is a 20 to 40-minute detention basin. A booster pump transports the water to a pressure filter for final removal of lighter precipitates.

As water percolates downward through the layers of coke it comes into prolonged contact with air that is pocketed in the porous structure of the coke or is circulating through the voids between the coke. As it combines with oxygen from the air, iron is converted to its oxidized state. The heavier oxides settle in the detention basin while the light-



● **OPEN COKE TRAY method of aeration is most commonly used for removal of iron.**

er ones are trapped on the upper portion of the filter bed where they are removed by backwashing. When excessive CO_2 is present in the water it may be necessary to add an alkali, as soda ash, caustic soda, or lime, to neutralize the excess gas and prevent service line corrosion.

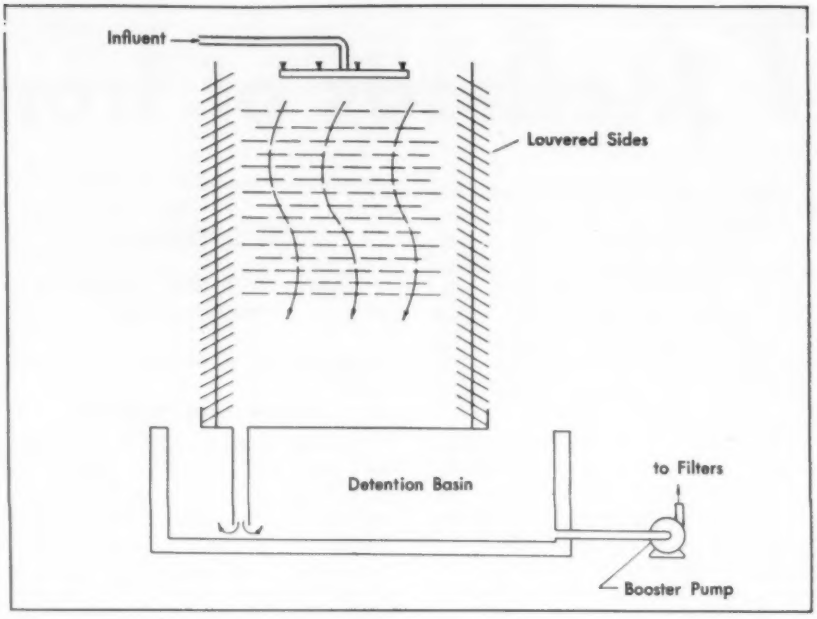
Open Slat-Tray Aeration is similar except that wooden slat trays are used in place of the coke trays. The unit is made up of a large number of horizontal cypress or redwood slats arranged in staggered tiers. The framework upon which the slats rest is usually enclosed on all sides with wooden louvers. Water cascades from tier to tier, coming into frequent contact with circulating air. Iron is oxidized and liberated carbon dioxide and hydrogen sulfide gases are carried away by the air. As in the first method an alkali feeder is provided to neutralize any excessive CO_2 remaining in the water. Slat tray aerators are often preferred to coke tray aerators because the slats are easily removed for cleaning and periodic replacement of coke beds is eliminated. Coke trays, however, usually provide more complete aeration.

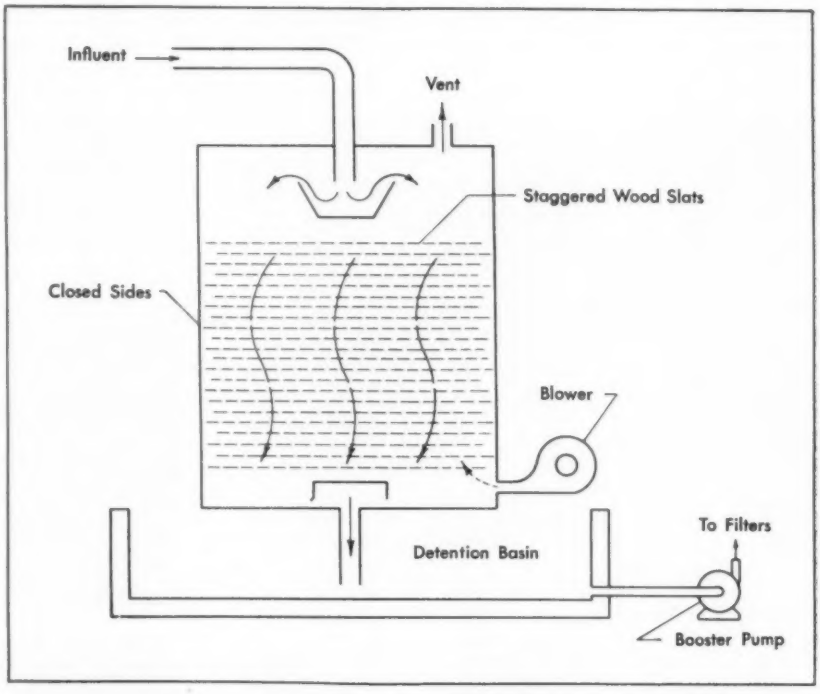
Closed Forced Draft Aeration utilizes water cascading down through staggered wooden slat trays enclosed within a cylindrical tank. A motor driven blower forces pressurized air upward between the slats, counter-current to the flow of the water. Iron is thus oxidized and carbon dioxide and hydrogen sulfide gases are liberated. The forced draft aerator is more expensive than the first two but it has these advantages: it can be operated successfully at a higher flow rate permitting use of a smaller tank; the volume of air delivered to the aerator can be correctly proportioned to the amount of iron in the water; the unit can be located either indoors or outdoors.

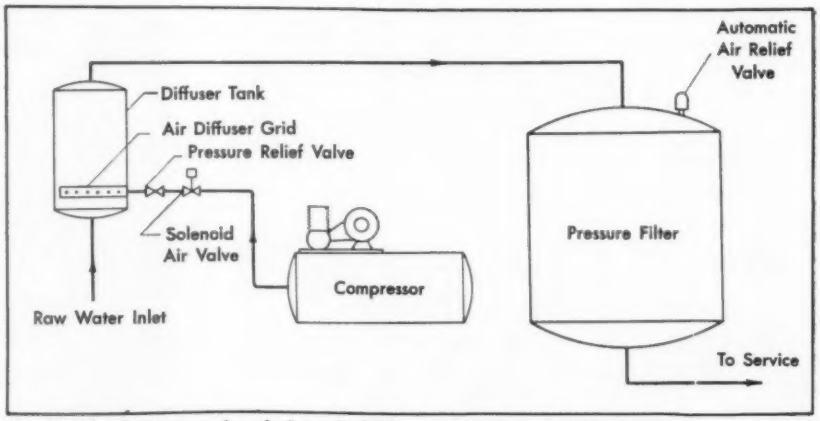
As in other aeration methods, iron is passed through standard pressure or gravity filters where final removal of iron is accomplished.

The Pressure Diffuser aerator is ideal for small plant operation because of its economy and compactness. It consists of a cylindrical pressure tank in which a perforated distributing pipe is located near the bottom. As raw water flows upward through the tank, compressed air is injected into it by means of the distributor pipe. This supplies enough oxygen to oxidize any iron present in the water before it reaches the filter bed.

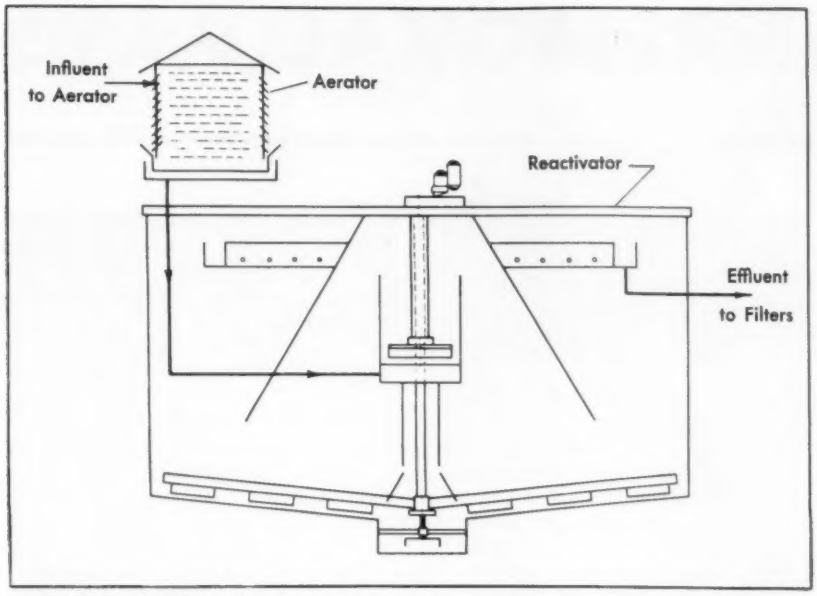
The flow of air to the aerator is automatically coordinated with the







● **OPEN slat-tray, closed forced draft and pressure diffuser aeration methods.**



● **PRECIPITATION and solids-contact process removes iron, hardness and turbidity.**

flow of water through the diffuser tank by means of a solenoid valve in the air line between the compressor and the diffuser tank. A needle valve in the air line ahead of the solenoid valve permits manual proportioning of the amount of injected air to the amount of iron in the water. A distributor baffle in the top of the filter tank effects the release of air entrapped in the water. This air then escapes through an automatic air relief valve adjacent to the baffle.

Precipitation and Solids-Contact

When hardness and turbidity removal is required in addition to iron removal a solids contact unit (such as the Graver Reactivator) may be effectively employed. Complete treatment can be accomplished in the one unit. Depending on the nature and amount of iron found in the water three arrangements are possible each calling for standard pressure or gravity filters to follow the solids contact unit.

The first arrangement provides for removal of iron mainly by catalytic action and coagulation. Higher oxides of iron, present in the sludge bed, act as a catalyst between the iron and the dissolved oxygen in the water. The resulting precipitation is assisted by a coagulant and produces a clarified water substantially free from iron.

In the second arrangement an air grid sludge recirculator is substituted for the standard mechanical impeller recirculator. This introduces oxygen to the water and oxidizes the iron more completely.

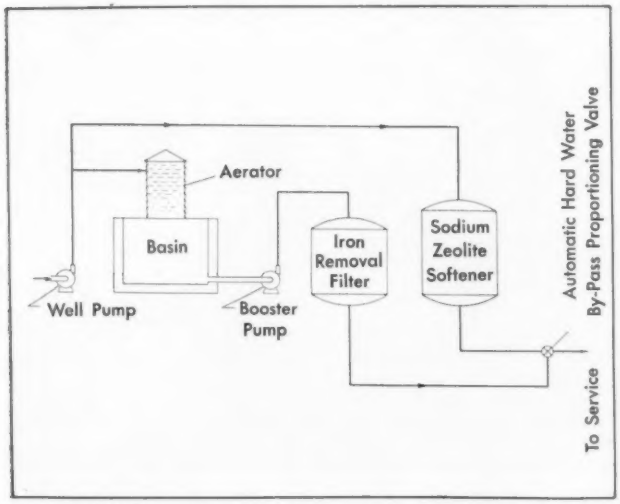
The third arrangement provides for an open aerator mounted on the reactivator. This is particularly effective when, in addition to high iron content, the raw water contains an excess of carbon dioxide and hydrogen sulfide gases. Air, sweeping through the aerator, provides enough oxygen to hydrolyze the ferrous compounds and simultaneously carry off liberated gases.

Zeolite Softening

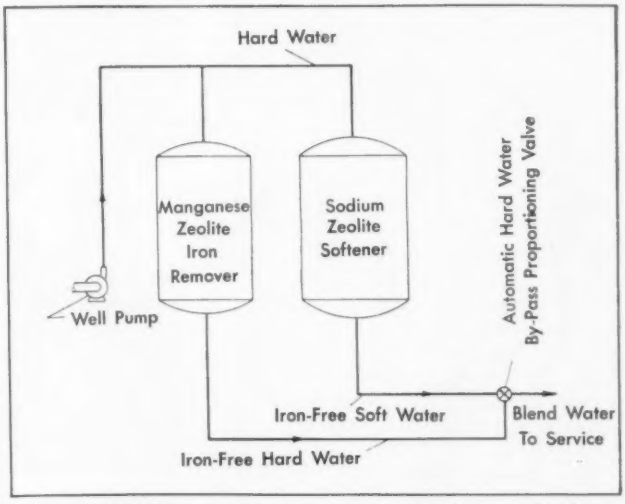
Sodium Zeolite Softening—When water softening is desired along with iron removal a blending process is often used. The main flow of water is pumped directly to the sodium zeolite softeners where iron is removed and hardness reduced to zero by the base exchange method. Since the desired standard for hardness in municipal water supplies is 3 to 5 grains per US gallon, bypassed raw water, which has been treated for iron removal by aeration and filtration, is added by means of a by-pass proportioning valve to produce the correct hardness.

Manganese Zeolite Softening—In this method a manganese zeolite iron remover is used in place of the aerator and filter. The iron-free hard water from the manganese zeolite iron remover is then blended with the iron-free soft water from the sodium zeolite softener to provide the desired degree of hardness.

The seven systems discussed here incorporate most of the common methods of iron removal. Obviously, the choice of a method or combination of methods depends on many considerations. Because of the variety of possible combinations, however, proper evaluation of the factors involved will indicate which one will produce and insure the desired results in any iron removal situation.



● **SODIUM zeolite softening combined with iron removal.**



● **MANGANESE zeolite removes the iron but not hardness.**

LEAF REMOVAL PAYS

WOULD YOU PAY a dollar for a bag of leaves? That's the price in Toronto and they have more buyers than leaves. There is nothing special about the leaves that grow in Toronto; they are no different than the leaves which litter every other city or town in the Fall of the year, blocking gutters and drains, and harassing the Street Cleaning Department in general. There is something special, however, about the leaves in the $1 bag, for they have been carefully composted, shredded and screened to form 80 pounds of fine leaf mold, the best humus you can buy.

It is Commissioner H. D. Bradley of the Street Cleaning Department who has been responsible for the leaf mold project which has grown from preliminary experiments in composting to the present Leaf Mold Division, headed by J. E. Clarke. Collecting and hauling leaves for disposal in dumps outside Toronto was a sizeable annual expense for the Street Cleaning Department. Now, this expense has been fully compensated by the production of a salable product from material that used to be destroyed. In addition the Park Department has available at no charge all the rich humus it requires for the city parks and gardens, and the people of Toronto have an excellent source of material for beautifying their own lawns and gardens. It appears that everyone benefits.

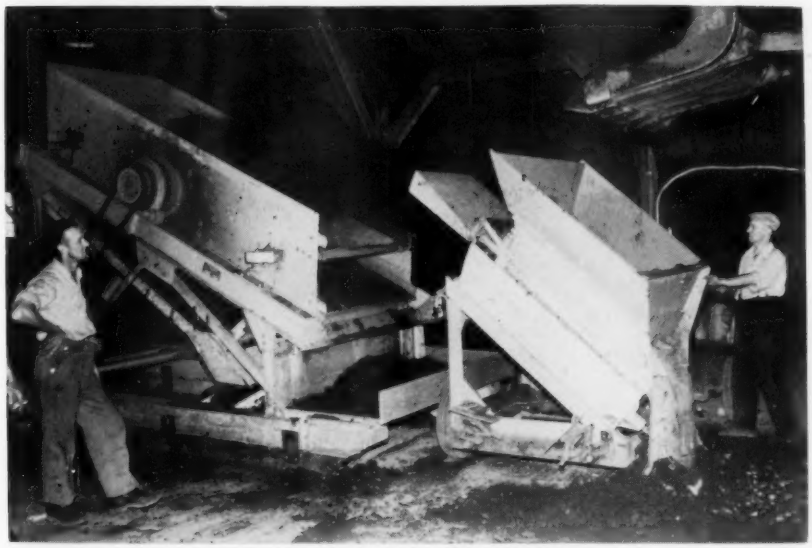
In the Fall of the year the street cleaning equipment is utilized for leaf removal on days when it is not assigned to trash and garbage collection. Often it is necessary to hire additional trucks to handle the peak loads, for while some suction equipment is used, much of the loading is done by hand shovelling. Since the period for collecting fallen leaves is short and the volume is very large, the leaves are initially stored at six points located conveniently about the city to minimize hauling time during the busy season. During the Winter months and early Spring the leaves are moved to the central leaf mold operation as time and available equipment allow.

The Toronto Municipal Leaf Mold operation is located in a ravine not far from the center of the city. Here the leaves are piled in long heaps called "racks." Each rack of leaves measures 50 ft. wide by 100 ft. long x 10 ft. high and contains approximately 600 tons. The leaves are contained in the racks by portable fences which separate the racks by five or six feet allowing access to the side of the racks for testing the composting progress. Composting of any organic matter creates heat, so by inserting a thermometer several feet into sides and top of the rack of leaves, it is easy to plot the progress of the composting. The interior of the racks are insulated from the cold by the nature of their size, allowing the composting to continue through the Winter. On cold days

● **SOME of the racks which hold the composting leaves, showing the method of separation and side support. Each rack contains approximately 600 tons of compost.**

● **COMPOSTED leaves are being cleaned and shredded with a Royer shredder. The photograph shows the texture of the material which has good value as fertilizer.**

ITS WAY IN TORONTO



● **FINAL operation consists of a second shredding in another Royer unit, followed by passage through a Niagara oscillating screen with small mesh openings.**

some heaps are said to emit steam.

Neither additives nor pre-shredding are used to speed the composting. A new rack of leaves is seeded with screenings of finished compost which are left over from the final shredding and screening process. Moisture control, regular turning over of the racks, and time (two years) are all that are used to control the composting. In the hot dry Summer months it is often necessary to spray the racks in order to maintain the moisture content necessary to good composting. Proper aeration is achieved by turning the racks over every six or eight weeks, as conditions dictate. A line of 16 racks are in continuous operation side by side. When a rack of finished leaves is taken from the end of the line, each rack is turned over by the bulldozer and moved up one position. A rack of new leaves is then added to the beginning of the line. There is a stockpile of new leaves waiting to enter the system at the beginning of the line and at the end of the line is a stockpile of finished leaf mold waiting to be shredded, screened and bagged.

The leaf mold which has finished composting is still far from being a marketable product; its texture is very coarse and the refuse it contains varies from pop bottles to bricks and coat hangers. Tractors with front-end buckets are used to load this leaf mold into a large portable Royer Shredder for the removal of trash and the initial shredding. A 12-cubic foot bucket of material is cleaned, shredded and discharged in approximately 15 seconds. This separation takes place outdoors near the stock pile of leaves which have finished composting. As the leaf mold is cleaned and shredded it is hauled to indoor stock piles by larger tractor buckets.

The final operation takes place in a large shed. Here the leaf mold is shredded a second time in another large Royer Shredder. A tractor bucket is used to load the shredder and the long discharge stream from the shredder in turn feeds an oscillating Niagara Screen with a small mesh. The screen cleans out the fine pebbles and twigs, allowing a very uniformly graded and cleaned humus to pass through to a brick toting conveyor rigged for bagging. The finished product has exceptional capacity for holding moisture and is applied in gardening as a humus. Its fertilizing value is 2-2-2, similar to good manure, while the pH of the regular leaf mold is 7. Oak leaves from parks and areas which are predominately oak are composted for three years, processed and sold separately as an acid leaf mold. A 4-ply bag with a polyethylene interior is used to hold 80 pounds of the finished product. This is the bag of leaves that costs a dollar in Toronto and it is worth every penny.

● **FINISHED product is being inspected by J. E. Clarke, Superintendent of the Leaf Mold Division, during the bagging process. The leaf mold sells for $1 per bag.**

Winter MAINTENANCE and DRAINAGE

H. A. RADZIKOWSKI, Chief, Maintenance Branch, Bureau of Public Roads

MAINTENANCE of roads and streets is defined as the preserving and keeping of each type of roadway, roadside, structure, and highway facility as nearly as possible in its original condition as constructed or subsequently improved, and the operation of highway facilities and services to provide satisfactory and safe highway transportation at all times. Today, this is a very large order. Furthermore, it becomes more important each year that this maintenance responsibility be fully discharged for the motor vehicle is inseparably integrated into the economic, social, and welfare activities in this Nation.

Last year, about $1.7 billion were expended to combat the deteriorating effects of nature and over 55 million motor vehicles on our 3,400,000 miles of roads and streets. The fact that highway users were able to travel over half-a-trillion vehicle-miles during 1954 is a tribute to the measure of success attained by some 350,000 men who labor hard and long in preventing deterioration of our roads and streets.

One of the most difficult tasks faced by the maintenance men of the 36 States in our snow belt is to keep roads and streets open and safe for travel in the winter. Furthermore, they must prevent deterioration resulting from the severe climatic conditions which occur during the winter months.

The winter maintenance activities of an efficient highway department may usually be divided into two phases, one operational and the other preventive. For example, when snowdrifts block a highway, an operation is required, namely, plowing the snow off the traveled way. On the other hand, highway departments erect snow fences, plant snow barriers, cut weeds in the fall, flatten backslopes, and otherwise try to prevent snowdrifts forming on the roadway. Such measures cut down on the operational effort required and thereby foster greater economy.

● **BREAK-UP: Serious damage to the road surface may result during the spring thaws if water from melting snows cannot drain quickly away from the roadway.**

The maintenance of drainage systems is a most important and essential part of any successful winter maintenance program. A properly functioning drainage system pays tremendous dividends not only in reducing the operational requirements for winter maintenance but also in preventing deterioration resulting from winter climatic conditions. If, for example, you insure that water from melting snow will drain quickly away from the roadway, you will in many instances save yourself the costly operation of treating an icy pavement when snow water which could not escape freezes at night. In addition, you provide greater safety for highway users. At the same time, you prevent that snow water from seeping into the substructure of your road where it could build up the ice lenses that cause heaving which destroys the stability of base and sub-base so that during the spring thaw serious failures in the surface usually result. Maintaining the drainage system, then, may be considered as one of the preventive phases of winter maintenance on a road section.

This relationship between drainage and winter maintenance is demonstrated in a study made a few years ago by the Bureau of Public Roads and a State highway department. While the emphasis in this study was upon utilization and production rates for labor and equipment employed on highway maintenance, the data obtained therefrom show the timing of various drainage maintenance operations during a full year in relation to winter maintenance performed during the same period.

The area involved in this study contained 247 miles of State highways, all of which are paved either with portland cement concrete or bituminous materials. Both rural roads and urban streets are maintained. The climatic conditions during the year of the study conformed to the 46-year average for the area with slightly milder temperatures, somewhat less snow and sleet, and less precipitation during the fall and winter months. There were 11 days when an inch or more of snow, sleet or hail fell and there were 16 days of sleet and glazed ice. Some snow fell on 42 days and freezing and thawing temperatures occurred on 98 days.

Labor Workload—An average of 1,430 men, exclusive of foremen

● **STORM water eroded the fill slope at this point. Maintenance forces installed the pipe shown to carry the water to the toe of slope and prevent such erosion.**

and crew leaders, were employed during the 1-year period to maintain highways in the study area. They worked 173,656 man-hours of which 143,067 man-hours were on routine maintenance operations and the remaining 30,589 man-hours on betterments. Of this total man-hours worked by these employees, 30 percent or 52,097 man-hours were devoted to snow and ice control operations and an additional 13 percent or 22,575 man-hours to drainage maintenance. A substantial portion of work performed under other headings might be included, too, since they are so closely allied to winter and/or drainage maintenance. Repairing snow fence, stockpiling abrasives and chlorides, blading shoulders to remove sand resulting from ice control operations and to facilitate drainage, repairing washouts caused by storms, etc., are operations in this category.

Equipment Workload—A total of 55,928 hours of equipment working time was used to maintain these highways during the study year. Direct snow and ice operations required 30 percent or 16,779 hours of the total while drainage maintenance accounted for an additional 9 percent or 5,059 hours. Also, 5,100 hours of equipment time were used in stockpiling sand and salt for winter maintenance, for mixing calcium chloride with sand and loading it into trucks, and to repair snow fence. This means that 26,958 hours or over 48 percent of all equipment used was involved in winter and drainage maintenance.

Preparations for Winter

When the study started in the third week of August, it was evident that the maintenance organization was mindful that the fall rains and winter snows were not too distant. Over 24 percent or a total of 215 hours of all available equipment working time in a day was being devoted to the maintenance, repair, and replacement of drainage facilities. The breakdown of the various operations, with the daily hours of equipment use involved was as follows: Cleaning catch basins, grates and gutters 35 hours; cleaning and reshaping ditches 25 hours; cleaning catch basins and sumps with an eductor 53 hours; laying drainage pipe 30 hours; and replacing drainage structures 72 hours. The total for these was 215 hours.

In addition, 100 equipment-hours a day were being used to seal cracks and joints to prevent the infiltration of water. Maintenance equipment was being used at the rate of 265 hours a day in surface replacements and armor coating which, although not drainage maintenance items, certainly would facilitate the movement of water into drainage channels. Likewise, shoulders were being patched and reshaped at least partially for the purpose of getting water away from the surface and 100 equipment-hours a day were being used in the process.

The use of equipment to clean catch basins, sumps, gutters, and ditches continued at about the respective rates shown above through the month of October except for peaks following the fall rains which came with increasing frequency from September 9 on. Other direct drainage maintenance activities declined somewhat as fall mowing, surface maintenance and replacements, and last-minute landscaping operations increased before the season closed. Drainage considerations as well as winter maintenance operations were, of course, involved in these latter activities.

Drainage maintenance activities, except for laying pipe, practically ceased during the first week in November. Nearly all equipment and personnel were employed in erecting snow fence and stockpiling winter salt and sand. Rain plus the alternate freezing and thawing temperatures during the second week caused 175 hours of equipment use on drainage maintenance on November 16. The operations performed were cleaning ditches, lay-

● **SNOW fence, like this installation made by the Vermont Highway Department, can reduce work of plowing.**

ing pipe, constructing catch basins, and marking drainage structures. The latter, such as culverts, catch basins, etc., were marked by an arrow painted on the pavement opposite the structure. Most highway departments prefer to drive a colored stake, long enough so that it won't be covered with snow, beside these drainage facilities so that they can be located readily for cleaning or thawing out during the winter.

Value of Preventive Maintenance

It is interesting to note that in the 24 days from November 16 through December 9 there were 19 days when snow, sleet, or rain fell and 12 days which had alternate freezing and thawing temperatures but no salt or sand had to be applied to the paved surfaces in the area until December 10. This is a good indication of the value of the preventive measures taken in respect to drainage facilities in reducing the winter maintenance operational requirements. If, through lack of maintenance and repair of drainage and appurtenant facilities, water had not been able to move quickly from the surfaces, the application of salt and sand would have been necessary on at least some of these days.

On December 10, rain turned to snow and with the temperature falling to below freezing, salt was applied to pavements in the area for the first time to prevent ice from forming. About 80 hours of equipment time were used for this purpose. The following week similar climatic conditions prevailed every day with sleet storms on December 15 and 16, and the equipment usage for applying salt rose to 450 hours per day. In addition, the first plowing of the winter was done, using 70 hours of equipment time each day to remove slush from surfaces and shoulders.

Drainage Maintenance—In the meantime, because of the almost continuous precipitation, drainage maintenance rose sharply to the high for the year when, on December 10, 295 hours of equipment time were used on the operations listed above. Cleaning ditches and catch basins were the major items, using 170 and 60 hours, respectively, of equipment time. There can be no doubt as to the importance attached by this highway department to drainage facilities which are open and functioning when winter comes.

A cold snap the week before Christmas necessitated a new drainage operation, that is, clearing ice from catch basin inlets and other waterways. Most highway departments use steam from a boiler, tank-car heater, or other source to thaw frozen culverts and catch basins. In the area studied, however, the work was done by hand. As a consequence, the equipment use was relatively small, amounting to only 1,650 hours total that winter even though it was a daily work operation from December 15 through March 13.

A heavy snow storm that started Christmas Day, combined with low temperatures, resulted in a sharp drop in drainage maintenance to almost no activity as all employees turned to snow plowing, applying sand and salt, and clearing snow and ice from bridges, waterways, and intersections. The cleaning of ditches and catch basins was resumed the first of January after the storm and continued through the month. Warmer weather during the last two weeks of the month permitted the use of the eductor each day to clean out catch basin sumps.

Snowstorms the first week in February and again during the first week in March caused temporary lulls in drainage maintenance activities. Snow, sleet, or rain fell almost daily during February and March and, coupled with below-freezing temperatures on 41 of the 59 days, necessitated daily applications of sand and salt to prevent icing. As a result, sand accumulated in large quantities in catch basins and gutters. Cleaning catch basins, sumps, and gutters was stepped up by maintenance forces, reaching a peak of 205 hours of daily equipment use, to insure that drainage facilities would be open and functioning when the spring thaw started. Primarily for the same reason, the removal of winter sand from shoulders started the latter part of March, and during the second week in April reached a peak of 545 hours a day of equipment use.

As the weather warmed up, snow fence was removed, winter sand cleaned up from pavements, and preparations begun for the new season. Drainage facilities were being cleaned continuously with peaks occurring after each spring rainstorm. Laying new pipe became a major drainage maintenance activity. As the study came to a close in August, much the same activities as were noted the previous year were being carried on in the effort to remove water from roadways quickly to prevent damage to the surface and reduce winter maintenance operational requirements.

● **THAWING out frozen culverts is often necessary to prevent water damage to road.**

Drainage Maintenance Practices

Most highway departments are well aware of the importance of adequate drainage, particularly during the winter and spring months. They perform much the same operations in the 36 snow States that were found in the study area in maintaining, repairing, replacing and improving drainage facilities. It is believed, however, that the average highway department would have

mechanized some of these operations to a greater extent than the area studied. For example, in cleaning ditches, the average crew consisted of three men, a driver, a truck, and an assortment of hand tools. These men cleaned an average of 0.23 mile of ditch and loaded the slough into the truck in a 9-hour working day. In contrast, most highway departments clean their ditches with a motor grader, blading the spoil into a windrow on the shoulder. This material is then picked up by one of a variety of mechanical loaders and dumped into trucks. The only hand labor involved might be one clean-up man to brush spilled material from the pavement. Instead of a quarter of a mile, most highway departments customarily clean 3 to 5 miles of ditch in a day with this equipment. Savings on loading spoil material mechanically alone have been found to range anywhere from $20 to $431 per mile over hand-loading methods.

Routine Drainage Maintenance—As in all maintenance operations, this trend toward mechanization is evident to an increasing extent in drainage maintenance. The eductor used in the study area to clean out catch basin sumps is a typical example of a machine developed to eliminate hand labor wherever possible. This machine consisted of a tank, two auxiliary engines and two pumps mounted on a truck. These were connected to a canvas hose water line, a flexible tubing suction line and a water jet pipe. The catch basin to be cleaned was filled with water from the tank and the jet pipe used to stir up the material in the sump to get it in suspension. Then the pump speed was increased to start the suction action and the sludge was drawn up through the flexible tubing into the tank. About 6 to 9 basins could be cleaned before the tank had to be emptied of sludge and refilled with water. An average of 16.3 catch basins were cleaned per 9-hour working day by a crew of two men consisting of a truck driver and helper.

Many highway departments use small cranes for this purpose. The principal reason is that the crane, unlike the single-purpose eductor, can be used for a variety of tasks in addition to cleaning out catch basin sumps. They can be used to lay pipe, to load or stockpile materials, remove debris lodged against bridges and to perform a multitude of tasks around equipment yards and repair shops. These light cranes are either truck-mounted or self-propelled on pneumatic tires. A small orange-peel bucket is usually used for cleaning catch basins.

● **CATCH-basin of this type must be shoveled out by hand after each snow. Coordination between maintenance and design divisions can prevent such hand operations.**

The most common failure in subsurface drainage systems is clogging of backfill material and pipe. If the backfill material is clogged, it usually must be removed and replaced. In the past few years, the trend has been toward a finer gradation of granular material than was formerly required. Drain pipe and tile are usually cleaned out with jointed or flexible sewer rods operated either by hand or machine. These rods can be equipped with a variety of heads for loosening sediment, cutting roots, etc. Sewer cleaning machines are also used where feasible.

Storm sewers, found mostly in urban areas, are commonly cleaned by rodding and flushing. Sewer cleaning machines of the bucket type are also used. Rubber balls, inflated to slightly less than the inside diameter of the pipe, are employed by some cities. The ball causes a head to be formed which scours the pipe ahead of the ball and washes the sediment down to the next manhole where it can be removed.

Culverts should be inspected frequently, particularly after storms and during the winter months, to see that they are open and in good repair. Vegetation frequently obstructs, at least partially, the inlet or outlet and must be removed to restore the designed capacity. Debris from storms sometimes blocks the inlet and if not removed promptly may result in a saturated subgrade or scour. It is frequently necessary to correct undermined inlets, outlets and headwalls of culverts usually by riprapping, by channel alignment changes to improve flow into or out of the culvert or by extension of aprons.

Other routine drainage maintenance items, while minor in respect to the total work load, are essential to preserving the structural integrity of the highway and in many instances facilitate winter maintenance. These include mowing brush and weeds in ditches and other surface drainage channels. It is sometimes necessary to install checks in ditches where erosion has been caused by the velocity of the runoff. Drainage features, such as weep holes in bridges, retaining walls and other structures must be kept open to prevent damage or an additional winter maintenance problem.

Extraordinary Drainage Maintenance—In addition to routine drainage maintenance, maintenance forces are often required to perform work of an extraordinary character to secure proper drainage. This is usually necessitated by storms of unusual severity, changes in characteristics of an area or by defects in design or construction of drainage facilities. A storm resulting in a flood, for example, may wash out a culvert completely and require

replacement. Likewise, the construction of a new subdivision in what was formerly a wooded rural area may drastically change the runoff characteristics of a drainage area and make the existing drainage facilities of highways in the area inadequate. This situation occurs frequently at the present time due to the trend toward decentralization of our population into suburban and rural areas.

There is little the maintenance engineer can do as far as storms or changes in an area are concerned except to provide the necessary repairs, replacements or betterments to restore the drainage system to adequacy. But there is much that he can accomplish in respect to deficiencies due to design or construction.

How to Do Better

If each maintenance engineer of each State, county and local highway department would accept the responsibility of formulating his own experience in maintaining various drainage facilities and making this data available to design and construction engineers, it is certain that some of the excessive drainage maintenance that is now required could be substantially reduced on future highways. The proof for this statement lies in the fact that many of the characteristic features of our modern highways have stemmed from maintenance experience in the past. The trench type cross section has all but disappeared on new construction because some maintenance engineers brought their experience to the attention of design engineers. They had found that all too often water was impounded under the surface where it seeped into the subgrade. During the winter months, ice lenses could grow which displaced the base course and caused loss of its stability. Later, when the ice thawed, the water weakened the subgrade and many widespread failures in the surface occurred. Extensive surface repairs had to be made and often shoulder drains had to be constructed to prevent water from becoming impounded in the future.

Maintenance experience with narrow V-type ditches was largely responsible for the widespread adoption of the wide rounded-bottom ditch as a standard design. A ditch with such a cross section is less likely to erode, provides more snow storage space and eliminates in many instances the necessity of guard rail which interferes with snow removal and mowing in addition to requiring maintenance itself. The new ditch also fits into the stream-lined cross section of the modern highway which greatly facilitates winter maintenance. The trend toward finer, graded material for backfilling subsurface drainage facilities is largely due to maintenance experience with the coarser material formerly specified which clogged up relatively quickly.

These and other improvements have been accomplished through the integration of maintenance experience with other highway engineering activities. But far more of this correlation in an orderly fashion is needed. Too frequently maintenance forces are required to build diversion or cut-off ditches at the top of cut slopes on newly constructed projects to prevent erosion and excessive maintenance requirements. The latter include restoring and replanting the washed slope and removing the eroded material from drainage facilities. Much the same necessity sometimes occurs in respect to new fills, too, where adequate provision has not been made to carry surface water from the roadway to the toe of the fill slope. In such cases maintenance forces have been required to install pipe or gutters together with the necessary backfill and to replant the slope in order to correct the drainage and prevent future excessive maintenance requirements.

Not long ago a 4-lane divided highway, constructed to high modern design standards, was completed and turned over for maintenance. One feature of the drainage system was that catch basin gratings were set in a recess or cul-de-sac made by offsetting the lip curb into the raised median. This no doubt was sound hydraulic design. But from the winter maintenance viewpoint, it was another story. Every time a snow plow passed adjacent to one of these basins, crews of men had to follow to shovel them out by hand so the pavement could drain properly to prevent the formation of ice and seepage of water through cracks and joints into the subgrade.

Impounded subsurface water in cuts and fills which has not been discovered or taken care of through the construction stage frequently results in serious maintenance problems. Slides and slipouts often are caused by these subterranean waters. Maintenance forces must then clean up the slide material, replace or repair pipe lines or other drainage facilities damaged by movement of the slide, redress and replant the slope and often tap the subsurface water. This is done sometimes by jacking 2-in. or 4-in. perforated pipe into the cut or fill section until the subsurface water has been tapped and drawn off where it can cause no further damage.

Conclusion — Highway programs all over the Nation are or will be expanded. By and large these programs provide for the rehabilitation and reconstruction of our present roads rather than new construction. Maintenance forces have lived with these roads and know their weaknesses as well as their good points. This is particularly true of drainage for it is the most significant single factor that determines maintenance requirements on most sections of highway. It would, therefore, be advisable at this time for each maintenance engineer to review his drainage maintenance experience with those responsible for design and construction so that as the highways under his jurisdiction are rebuilt, future drainage maintenance requirements will be given due consideration.

● **PLOWING should be continued until shoulders as well as surface are cleared.**

GRAPHIC PANEL TYPE INSTRUMENTS for WATER and SEWAGE TREATMENT PLANTS

R. H. BABCOCK
The Foxboro Co.
Foxboro, Mass.

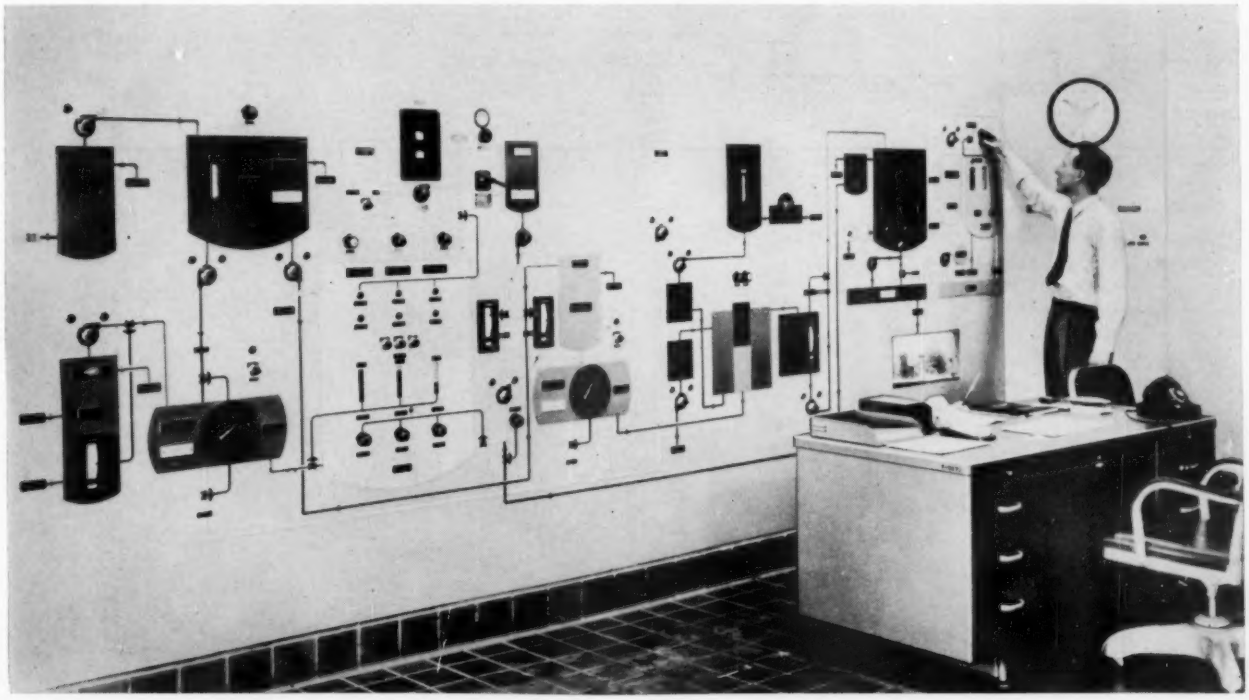
THE USE OF the well-known rectangular - case instruments, with approximately 240-square inches of area, on centralized control panels in water and sewage treatment plants has introduced a problem in space requirements; panels frequently become unwieldy and confusing. The graphic panel offers a relatively simple, understandable flow diagram of the process; with the components correctly styled and related to each other; with essential flow piping color-coded for easy identification; and with instruments located at the functional positions in the process.

Design of these units presented a challenge to the instrument manufacturers because if the graphic panels were to be compact, the surface area of the instruments must be small. Objectively, the graphic panel type instruments must retain the functional features of their larger counterparts without sacrificing accuracy, readability, performance and accessibility. Fortunately, in planning an instrument with a small surface area, in the order of 36 square inches, there was practically no limitation to the permissible depth of instrument behind the panel.

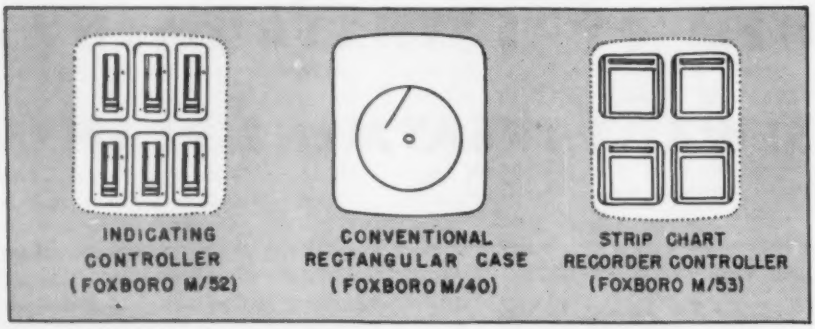
The conventional rectangular-case recorder-controller is approximately 14 ins. x 17 ins. on the surface and 5 ins. deep. The record is made on a circular chart approximately 12 ins. in diameter. The case may contain a direct measuring element or, if it is on a central control panel, a simple receiver element for measurement transmitted from a remote point. As a controller, it may have a complete proportional-derivative-reset unit; an additional measurement recorder element, a four-way transfer switch; a pressure regulator; a dual pressure indicator; a ratio unit; and an electrical signal system. The component flexibility has been developed over the years by user requirements. It is possible, therefore, to adapt the rectangular-case instrument to the simplest measurement problem or to the most complex operation with electronic measurement.

The recording feature is the major problem in adapting the many functions possible in the rectangular case to an instrument with 6-in. x 6-in. surface dimensions. A 12-in. circular chart is out of the question but the 4-in. measurement scale of the 12-in. circular chart is adaptable, if applied to a strip chart. The 4-in. measurement scale on the strip chart has the same measurement readability as on the circular chart; the strip chart will run for 30 days, at a speed of ¾-in. per hour and it may be continuously rewound or torn off daily.

In Fig. 1 (next page) is shown very clearly the relative sizes of the conventional rectangular-case and the different conventional graphic panel type instrument. Six of the M/52 indicating controllers shown at the right, each with complete components for process control



● **OPERATIONS of the cyanide treatment and silver recovery plant installed at Oneida Ltd., Oneida, N. Y., are recorded and controlled by this graphic panel board. Clear effluent is represented by a goldfish bowl. (Figure 2.)**


INDICATING CONTROLLER (FOXBORO M/52)
CONVENTIONAL RECTANGULAR CASE (FOXBORO M/40)
STRIP CHART RECORDER CONTROLLER (FOXBORO M/53)

● **COMPARISON of sizes shows how four or six graphic panel-type instruments will fit in same space as a single conventional rectangular case instrument. (Figure 1.)**

functions, can be mounted in the same space as one conventional rectangular-case instrument. However, as they are only indicating controllers and records are invariably desirable, a six-record recorder may be supplied with each of the six records individually distinguishable and identified with its respective controller. This recorder will require only the space of the rectangular case. With such an arrangement six controllers and six recorders require only the space of two conventional rectangular cases. It becomes apparent that it is possible to condense the size of centralized control panels quite materially and the operator can then observe all the instruments involved in a process without supervising a large area.

The conventional rectangular-case instrument continues to have its field of application for control operations which may be handled locally at the point of control; for cabinet types of panels where space is not at a premium; or where mounting conditions do not offer accessibility from the rear.

Typical Installations

Figure 2 shows a graphic control panel for the waste treatment plant at Oneida Ltd., Oneida, N. Y. Here, one operator runs the entire plant and it is possible for him to handle the entire process, including the automatic backwashing of filters, automatic chemical feeding and other operations without leaving the Control Room. Alarm signals warn the operator of any serious irregularities in the operating conditions.

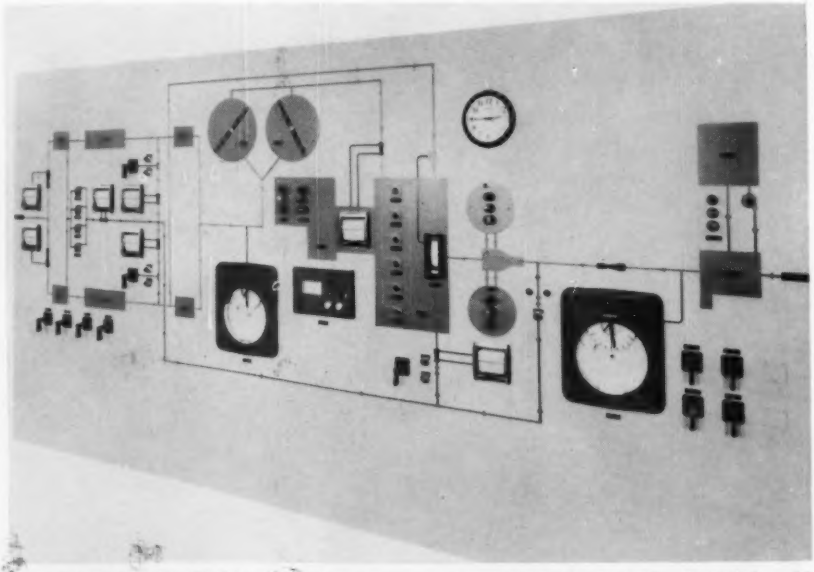
Figure 3 shows a graphic panel in which both the graphic panel type of instrument and the conventional rectangular-case instruments are used. This is the control panel for the sewage treatment plant at Durham, N.C. In this installation the electric valves are remotely controlled, their position is indicated and all measurement is recorded and indicated in the presence of the operator. Alarms are provided for essential measurements and it is possible to operate the entire plant from this control panel. From a public relation point of view, it is a decided advantage to be able to explain the entire treatment process to visitors.

The graphic panel type instruments are particularly adaptable where it is desired to reduce the size of the panel. It is possible to place all of the essential records at a central point, such as the Superintendent's Office, on a comparatively small panel, and indications are that such instruments will receive greater acceptance for applications of this type. A comparison of the conventional rectangular-case instruments with the graphic type instruments shows that the former will continue to have wide application in all fields of municipal and chemical processes. However, where graphic type instrument control panels are desired for saving in control panel space, for public relations, etc., the graphic type instrument is to be preferred. Interest in the public relations aspect of utilities has in recent years increased. The graphic panel is an important aid towards helping the public to understand treatment processes. Many water and waste plants display a schematic diagram of their system at the plant entrance. The graphic panel takes the schematic diagram one step further and operates the plant from the same location.

Training Made Easier

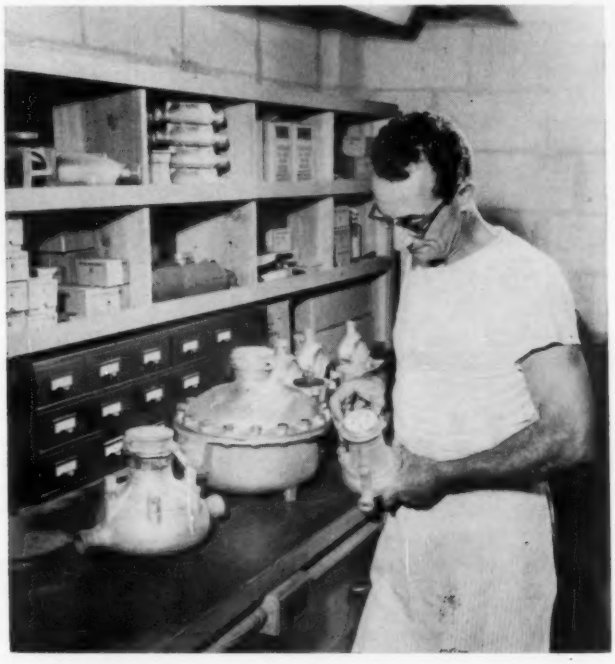
Operator training is always difficult where controls, switches, etc. are scattered throughout a plant. The graphic panel eases that problem by centralizing all control and providing a schematic process diagram. In most cases the number of persons actually engaged in plant operation can be reduced. This releases persons to perform maintenance duties which are often neglected because of the work of running the plant with local control.

In any installation all of the factors involved should be appraised very carefully before any decision is made regarding the type of instrumentation to use. Price is not necessarily a factor since the cost is substantially the same regardless of which type of instrument is used. In the last analysis, the economy may be in the ultimate size of the panel, but in any case, satisfactory performance is assured.



● **GRAPHIC CONTROL panel for a sewage treatment plant is illustrated by this installation at Durham, N. C. All plant units are represented and controls, position indicators and necessary measurements and records are conveniently grouped. (Fig. 3.)**

BENEFITS OF A METER MAINTENANCE PROGRAM



● **REBUILT** gear train being assembled in the Hollywood meter shop where all meters are repaired and where a filing system for each meter shows installation and repair data.

● **NOW** 100 percent metered (including public buildings and institutions); even contractors use metered water on all construction work. Shown is James Cipollone in the shop.

BENNETT R. BOLEN,

Director of Finance, Hollywood, Florida

A WATER METER maintenance program which Hollywood started less than two years ago on an emergency basis already is paying handsome dividends in reducing waste of water and increasing revenue. In the nine-month period ending June 30th, 1955, the water revenue totalled $339,590 representing an increase of $59,746 over the comparable nine-month period ending June 30th, 1954. This increase, in our opinion, can be attributed almost entirely to our meter maintenance program.

Drastic action was indicated in this resort city on Florida's lower East Coast when water department records showed that the rapidly growing municipality received payment for 6.5 million fewer gallons of water in the fiscal year ending Oct. 1, 1953, than in the preceding year, while pumping 37 million gallons more in 1953 than in 1952.

This sudden jump in unaccounted-for water led to a survey in December, 1953, which showed nearly half the meters out of order, a heavy percentage of the trouble being traceable to sand infiltration which followed extensive contract work on water lines. This situation pointed up the need for facilities to provide systematic maintenance.

An emergency replacement and repair program followed in the period from March to August, 1954, with the result that paid-for water increased from 854 million gallons in 1953 to 871 million gallons in 1954, while the pumpage figure dropped from 996 million gallons in 1953 to 923 million gallons in 1954.

Key to the successful program now consolidating its gains in Hollywood is standardization of meters and operation of an efficient meter shop. The city has settled on the Neptune meter because replacement parts are interchangeable in all models and all but some 200 of the 9,570 total are of this make.

The efficiency of the water distribution system is being further increased this year with a leak survey which is turning up numerous weak spots. Considerable water loss also has been experienced in recent months because of a sewer construction project which has resulted in many broken water lines. This job is to be completed before the end of 1955, however.

The necessity for new sewers points up the growth of Hollywood-By-The-Sea. The city was laid out 18 miles north of Miami in 1921, and was incorporated in 1925, just 30 years ago. Prior to World War II it was a lovely little resort community of fewer than 6,500 population. Today the permanent population, according to a recent independent census, is 23,000—a figure which is more than doubled during the peak of the winter season.

Hollywood offers its visitors a semi-tropical winter climate, plus

six miles of beaches, salt and fresh water fishing, boating, golfing and other recreational facilities. A horse racing track, a dog track and a jai alai fronton are in or near the city. For many years, the tourist trade was confined largely to the winter months, but like other Florida cities, Hollywood now is attracting many summer vacationers. The seasonal turnover of population naturally increases the city's job of checking and maintaining water meters.

The recently-constructed meter shop is essentially the heart of the expanding water distribution department. Here records are maintained on every one of the city's 9,570 meters; two men are constantly at work checking and repairing meters; and here the inventory of new and repaired meters is stored.

The rapid growth of the city, resulting in expansion of the water service and the installation of hundreds of new meters annually, allowed little time in recent years for the water department to worry over maintenance problems. When a meter got out of order, it was customary to give the subscriber a flat rate and leave him on it. The result was that millions of gallons of water went to customers who were not charged on a fair and equitable basis. The situation went from bad to worse until records showed that urgent action was needed to keep the whole system out of the red.

When the spot check in late 1953 showed about half of the meters out of order, a blitz approach to the problem was adopted. Three crews of two men each were assigned to do nothing but pull non-operating meters and have them repaired. As the repaired meters became available they were substituted for other meters, many of which were found to be recording less water than was flowing through them.

While this program was going forward, a veteran water department employee was selected to attend a manufacturer's meter school in Atlanta for training in repair methods. He came home to set up the present meter shop which he operates with the help of an assistant. Now all repairs are made locally and a filing card for each meter tells when it was installed, when it was repaired, and what parts were replaced. It is believed that each meter can be checked every five years under the current system.

Part of the overall program has been to see that all public buildings and institutions are metered and that contractors used metered water on all construction work.

The city's water supply is pumped from deep wells and chlorinated. All this costs money, and the water department sees the meters as cash registers which should receive something for each gallon of water that is pumped and distributed to anyone, anywhere.

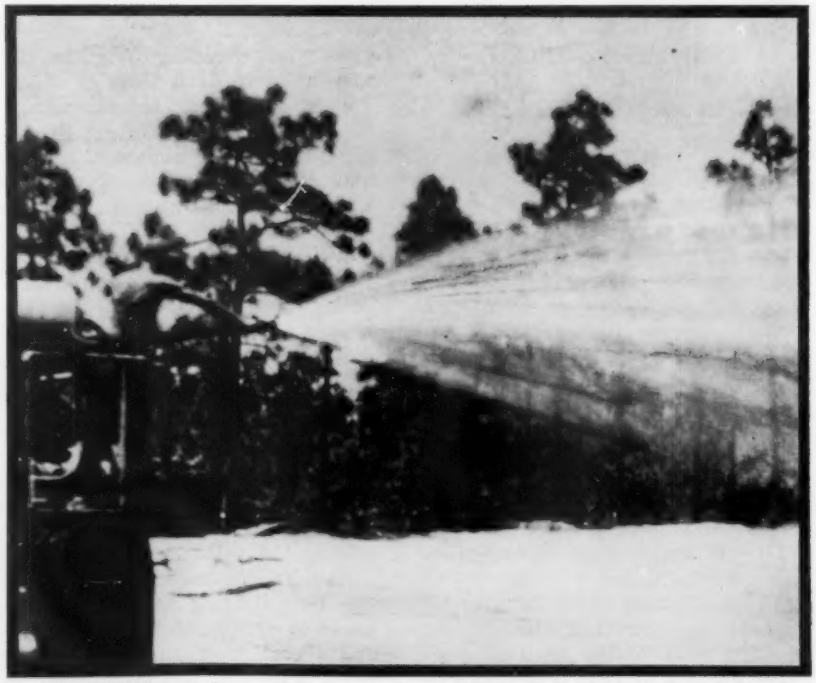
ROADSIDE *Seeding* and ASPHALT *Mulching*

JAMES A SAUNDERS,

Assistant Landscape Engineer, North Carolina State Highway and Public Works Commission

WITH THE exception of 2 miles on the north end, a section of US 421 runs west of Wilmington, N. C., runs some 15 miles through pure white sand ridges, with the height of some of the cuts exceeding 20 feet. It was realized during construction of this road that erosion of this sand, both by wind and water, would have to be controlled quickly if any shape was to be maintained on the shoulders, fill and cut slopes, and ditch lines.

At first it was planned to seed all areas and then mulch cut slopes over 4 feet in height with straw, but to use straw would be extremely dangerous from a fire-hazard standpoint. Also, the amount of straw necessary to do this job was not available. In seeking other



● **HYDRAULIC seeder used in western part of the state had to be employed on this job because the sand slopes would not hold seed drills and lime distributors.**

means of controlling erosion on this road, a report from a project in South Carolina was found which told of using emulsified asphalt for mulch. It recommended using this material as mulch only in cool weather, over topsoil which had been wet down with water to assure good penetration. This could not be done on this job because of the season of the year.

Another problem encountered while planning this work was getting machinery to stand up on the sand cuts to get the seed and fertilizer in the ground. It was realized that regular seed drills, and lime distributors would slide down the cut slopes and do a great deal of damage to the slopes. It was decided to use a hydraulic seeder developed and used by roadside crews in the western part of the state. The seeder mixes seed and fertilizer with water and sprays it over the area to be seeded, under high pressure. Sudan grass at 1½ lb., Korean lespedeza at 1 lb., and 6-8-6 fertilizer at 20 lb. per 100 sq. yd. were applied to all areas by the hydraulic seeder.

No seedbed preparation was necessary because of the sandy soil. The seed was covered by using a Ford tractor (with crawler treads) pulling a heavy section harrow, or weeder. It was found that on the cut slopes the ridges left in the sand by the section harrow were undesirable, as the mulch covered the front side of the ridge but the back was not covered. Thereafter another crawler-type tractor was used to pull a heavy board drag to smooth the soil before applying the mulch.

AE-5 emulsified asphalt at the rate of 0.2 gal. per sq. yd., was applied as the mulch. To obtain better penetration, an equal amount of water was added to the asphalt, which made a total application of 0.4 gal. of the mixture per sq. yd. The Emulsified Asphalt Company of Wilmington, N. C., supplied the material. Water was added to the asphalt at the plant, thus saving considerable time. The rate of application of the mulch was reduced 50 percent with the expectation of making a second application after it rained, but no rain came. The job was completed with the revised application, as it was planned to reseed in the fall and it was felt that the reduced application would hold the slopes until that time.

After the job was completed and all areas measured, it was found that 512,000 sq. yd. had been seeded and 134,000 sq. yd. mulched at a cost of 1.43 cents per sq. yd. for seeding and 1.55 cents per sq. yd. for mulching.

The reseeding and remulching with emulsified asphalt was started slightly more than six months after the summer cover crop seeding. It was decided not to reseed the large cut slopes to their full width because it would disturb areas that were under control by the summer application of mulch. It was felt that if an area 40 feet wide on each side of the road were stabilized with grass it would give a very pleasing appearance to the traveling public and that the areas beyond this point could be maintained by asphalt mulch alone.

The only operation necessary for fall seeding, other than that done for summer seeding, was pulling a peg-tooth harrow over the areas that were previously mulched, in order to break up the crust formed by the summer application of asphalt mulch. Seeding and mulching were done with the same equipment as the summer seeding except that a seed drill was used to apply the seed and fertilizer on all areas on which it could operate, which included shoulders, slopes to ditch, flat areas, and cut and fill slopes 4:1 and flatter. The hydraulic seeder was used to seed the steeper cut and fill slopes and to apply asphalt mulch on the cut slopes and other areas subject to wind and water erosion. All areas were seeded with rye grain at 2 lb., Korean lespedeza at 1½ lb., and fertilizer at 20 lb. per 100 sq. yd.

Emulsified asphalt was obtained from the same source and the water was added at the plant. Mulching was started using a 50-50 mixture of water and AE-5 emulsion and applying 0.4 gal. of the mixture per sq. yd. It was found that this mixture was forming a crust, and so the mixture was cut to 25 percent asphalt emulsion and 75 percent water. The same rate of application of 0.4 gal. of mixture per sq. yd. was continued; the mixture penetrated 1 inch and did not crust. All seeded cut slopes were mulched, plus the areas of the unseeded cut slopes that looked weak.

Good germination was obtained on all areas, except that the rye on the cuts seeded by the hydraulic seeder was dying, while the rye seeded with the drill was doing fine. Since this seed was planted in sterile sand, the only plant food obtainable was the fertilizer applied at time of seeding. This fertilizer was dissolved when applied by the hydraulic seeder and spread evenly over the ground. When harrowed in, it was scattered even more. Any rain that fell carried it deeper into the ground, thereby reducing the amount available for the plant roots. After germination and before the roots developed enough to collect this scattered plant food, it is believed that the plants starved. The cover on the areas seeded with a drill, where the seed and fertilizer were placed together in the ground, continued to grow well for eight weeks, at which time it started browning. These areas were topdressed with 6-8-6 fertilizer at 20 lb. per 100 sq. yd. The grass started growing again and has gone through the following seven months in good condition. All areas seeded with a drill have practically a full cover.

It was noted during this time that on the mulched areas the grass was greener and grew faster than on the unmulched area. No erosion has occurred on mulched areas, regardless of whether grass was obtained or not.

This article is from Roadside Development, 1955, published by the Highway Research Board which also supplied the illustrations.

● **ASPHALT emulsion was used to mulch roadside areas in place of straw which was not available and presented a fire hazard. Good seed germination was obtained.**

More LIGHT at Less Cost

PHIL HIRSCH

GROUP RELIGHTING has produced more street light at less cost in Elmhurst, Ill., near Chicago, where 72 Westinghouse OV20 mercury-vapor type luminaires have been installed along 10 blocks of the city's main and secondary business thoroughfares. The E-H1 lamp inside the luminaire is rated at 400 watts and 20,000 lumens, and has a rated service life of 6,000 hours. However, after approximately 4,200 hours, the lumen output drops about 25 percent. Beyond this point, the dropoff begins to have an increasingly noticeable effect on illumination level; by 6,000 hours, the average lamp is producing only 64 percent as much light as it did when new, and by 8,000 hours, the figure is 55 percent. Through group relamping, the effect of this decline in illumination has been substantially reduced.

Curves which Elmhurst's city electrician, Oliver Johns, obtained from the manufacturer prior to setting up the group relamping program show that before the 4,200-hour mark is reached, only about 10 percent of the lamps burn out. As service life increases, however, this figure rises. At 5,000 hours, for example, 13 percent of the lamps have burned out; at 6,000 hours, 15 percent, and at 8,000 hours, 20 percent. In other words, by replacing all of the lamps approximately every 4,200 hours, instead of at longer intervals, Elmhurst is able to nip the problem of decreased light output before it brings the illumination level down appreciably. The result is a mean output of about 16,000 lumens, less than 4,000 lumens under the lamp's initial rating.

"Elmhurst merchants paid for the new mercury-vapor system through special assessments. Their main purpose was to obtain more light for the streets along which their stores are located," explains Mr. Johns. "By letting burnouts and dimouts creep in, we feel that we're giving merchants less than they paid for."

How valuable bright lights are to the city's merchants, and to the community as a whole, since the new system went into service in December, 1953, is shown by the following figures:

● **20,000-Lumen mercury vapor lights are replaced on group, not spot basis.**

In December, 1952, sales tax collections amounted to $55,628. In December, 1954, a year after the lights went on, tax receipts amounted to $76,612. For the calendar year 1952, the figure was $544,423; for the calendar 1954, $719,668.

Shortly after the new luminaires were turned on, parking had to be banned along both sides of York St., Elmhurst's main thoroughfare, on Monday and Thursday nights. These are the nights stores remain open until 10 pm. Explains Police Chief Wilbert Rosteberg: "We couldn't handle the increased shopping traffic and permit curb parking at the same time."

Pedestrian accidents, although never a serious problem in Elmhurst, sent one or two victims a year to the hospital before the switch. Since the new lights have been in service, there hasn't been one injury or fatality in the 10-block area.

Besides the 72 lights installed in the two business areas, 12 more have been erected on the perimeter of two parking lots, located back to back a few blocks away from the center of the city. With the lantern-type incandescents that previously had provided illumination, petty thefts and vandalism were somewhat of a headache at these lots. Since the mercury vapor installation, however, the problem has been reduced virtually to the vanishing point, according to Chief Rosteberg.

The mercury-vapor luminaires were mounted 30 feet above the ground, atop pre-stressed concrete standards (manufactured by American Concrete Corp.), on a mast arm which places them about five feet out from the curb. Lights are stagger-spaced on some streets where the curb-to-curb width is 40 feet. On others, which have a pavement 30 feet wide, lights are located on one side. In the former system, spacing between standards on the same side of the street averages 190 feet; in the latter, about 95 feet.

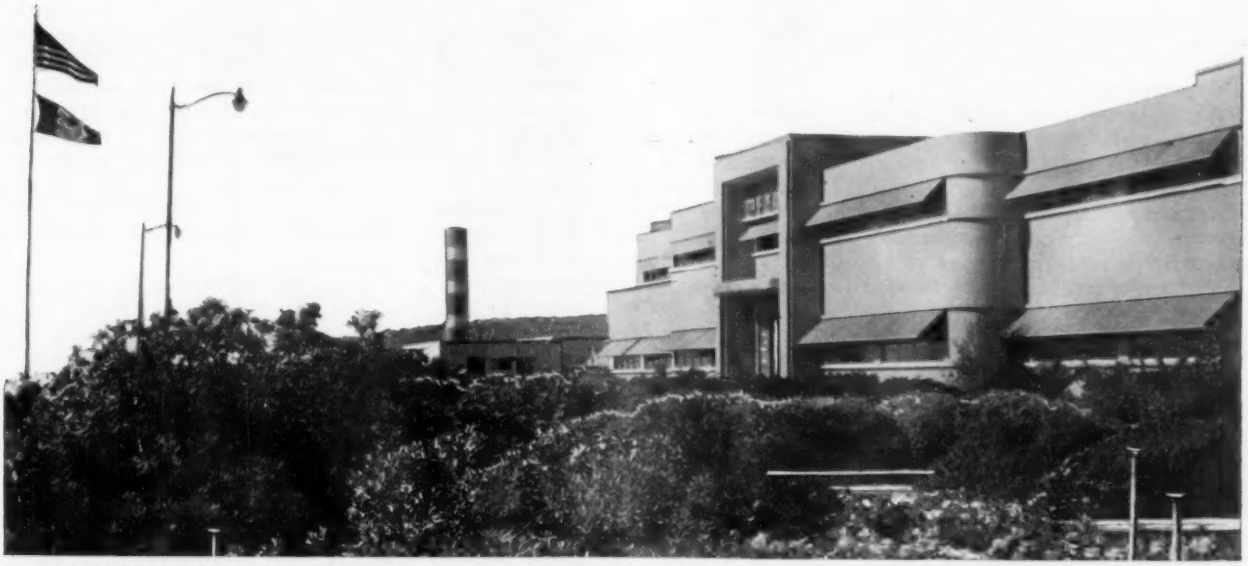
Total power requirements for the new lighting system are higher than for the 1,000 lumen incandescent lamps, housed in lantern-type fixtures, which formerly illuminated the two business districts. But each power dollar produces approximately three times as much light according to Mr. Johns.

This reduction in cost per foot-candle is only one of several economies which Elmhurst has obtained since the switch to mercury-vapor. Construction of the new luminaire makes it possible to replace each lamp and clean each fixture in a maximum of about five minutes, 50 to 75 percent less time than the old system required.

Taking the new fixture apart is simply a matter of unhooking a spring latch and pulling the refractor ring down and back. At this point, the outer end of the ring, which rests on a metal hinge, can be lifted out easily.

(*Continued on page* 119)

● **OLD lamps are still used in residential areas and are serviced from truck.**



● **ADMINISTRATION Building, Hyperion plant, Los Angeles, showing standard irrigation nozzle spray heads in flower bed.**

IRRIGATION *with WASTE WATER*

RALPH STONE, Consulting Engineer, Los Angeles, California

IN OUR ERA of rapid industrial and urban development, the value of water conservation is evident. The reuse of sewage and industrial waste waters for irrigation is a means of conserving our available water resources. However, a review of the history of sewage treatment indicates that broad irrigation was originally developed in the early nineteenth century as a system of both treatment and disposal. In recent years, other forms of waste treatment have become popular. The growth of technical knowledge has led to a re-examination of the possibilities of treatment and disposal of certain difficult industrial wastes through the application of irrigation techniques. Thus the cycle has run its course, the earliest form of waste treatment is now the subject of research and development for the disposal of the wastes of our time. Irrigation has been used for the disposal of effluents from canneries, paper mills, milk processing, pharmaceutical laboratories and frozen food plants.

However, irrigation with waste water is not a panacea for the economical treatment and disposal of all sewage and industrial wastes in all climates. Sanitary, aesthetic, economic, and other technical and practical considerations must be carefully balanced for a sound waste water irrigation system.

Golden Gate Park, San Francisco—Where water is both in short supply and costly, waste water reclamation may be an economically sound venture. This appears to be the case at the famous Golden Gate Park in San Francisco, Calif. The park utilizes treated domestic sewage for irrigation of approximately one-third the total park area. The sewage is first treated in a standard-rate activated sludge plant and is then chlorinated. The effluent was initially employed to maintain the water level in decorative lakes; later it was used also for the spray irrigation of park vegetation. About 0.65 mgd of effluent is reclaimed for feeding the decorative lakes and irrigating over 300 acres of landscaped lawns, shrubs, flowers and trees. Buffalo, deer and elk roam on part of this irrigated park pasture land. The screenings, grit and waste sludge resulting from the treatment process are discharged to a sanitary sewer and eventually flow to the Richmond-Sunset sewage treatment plant. The problems and expenses normally associated with handling these solids are thereby reduced. It is estimated (1) that the Golden Gate reclamation plant processes effluent at a cost of seven cents per thousand gallons. Additional pumping costs incidental to distributing effluent to the park irrigation system and reservoirs add another four cents for each 1000 gallons. In contrast, an equal amount of water purchased from the San Francisco domestic supply would cost 27 cents; thus costs are lower, even if it were not important to conserve the potable water for more important uses than irrigation. The reclaimed effluent meets bacteriological drinking water standards; it is treated so as to contain a 2 ppm chlorine residual. It has less than 5 ppm suspended solids and BOD. The fertilizer and soil conditioning value of the effluent make it more efficient for growing vegetation than equal quantities of potable water.

Irrigation of Grounds—Probably most large waste treatment works reclaim effluent for irrigation if they have extensive landscaping. The Hyperion Sewage Treatment Plant of Los Angeles, Calif. irrigates 35 acres of grounds with 0.45 mgd. The attractively landscaped lawns,

shrubs and flower beds contrast with the barren sand of the surrounding beach and sand dunes. The sewage treatment cost is about 18 dollars per mg; however, it is not fair to charge all of this to reclaiming water since the sewage must receive treatment regardless of further use. There are numerous instances, however, where the cost of otherwise necessary sewage treatment is included in the total cost of reclaiming the waste water, thereby giving an unfair picture of the economics of reclaiming effluent.

Irrigation For Other Recreational Uses — The El Toro Marine Base near Santa Ana, Calif., utilizes secondary treated sewage for irrigation of the Base golf course (2) Numerous other recreational installations can be cited where reclaimed waste water is routinely applied for the irrigation of grass and scrubs.

Fresno Sewage Farm—It has been previously noted that broad irrigation on a sewage farm was among the first methods of sewage treatment developed. Often as a result of municipal development there is a great increase in sewage flow on an existing sewage farm. The farm may then be over-irrigated to the point where sanitary and nuisance hazards develop. Excess flows should be disposed of by alternative treatment and discharge methods so as to avoid overloading the land.

The Fresno, Calif., farm has been in operation since 1907. Primary-treated effluent is used to irrigate forage crops grown for choice beef cattle. About 1290 acres of land were irrigated using more than 18 mgd in 1951. (3) Though rainbird sprinklers are often used for irrigation, the Fresno farm distributes effluent by means of lined channels and diked fields. The effluent in 1951 was reported (3) to have a suspended solids content of 75 ppm. Lagoons are employed to store excess effluent during rainy periods or peak plant flows. The Fresno farm in 1951 (3) showed an operating profit derived from the sale of beef cattle, as follows: Salaries and wages amounted to $18,945, and maintenance, supplies and services to $17,-304, a total cost of $36,209. Income from the sale of livestock was $45,-308. The gross profit was $9,059.

If there were no such farm, the City of Fresno would have to construct and operate secondary treatment facilities instead of the primary treatment plant used now. Water samples obtained from wells located on the sewer farm indicate that the percolated effluent is of a satisfactory bacteriological quality which will meet drinking water standards. The major farm operating problems result from the lack of by-pass facilities during high flow and wet weather.

Other Sewage Farms—Melbourne, Australia, and Berlin, Germany operate sewage farms. In the United States, land and climatic factors are favorable for the use of sewage farms in some of the southwestern states. Bakersfield and Ontario, Calif., have such farms. Cotton, alfalfa, fruit trees, grapes, citrus, nuts and grasses are common crops. Sanitary and aesthetic considerations rightly restrict the types of crops irrigated with a partially treated effluent. No disease transmission has been reported in recent years as a result of the use of reclaimed effluent for irrigation purposes.

Sale of Effluent — At Pomona, Calif. the chlorinated effluent from the city activated sludge treatment plant is sold to two private consumers. The Diamond Bar Ranch in 1951 utilized 278.2 mg on some 211 acres of pasture land and paid the city $6,440 for the effluent. The North Side Water Company during the same period used 220.8 mg to irrigate 380 acres of orange and lemon groves, 95 acres of walnuts, 40 acres of pasture, and 35 acres of alfalfa, paying $4,090 for this water. The two waste water users require irrigation only during the 8 arid months of the year. Hence, only 50.8 percent of the flow of the Pomona plant was purchased in 1951. The farmers report that the beef cattle prefer to drink effluent rather than potable well water and that the effluent will grow a third more grass than equal applications of well water.

Irrigation With Industrial Wastes —During the past few years, the treatment and disposal of certain industrial wastes by irrigation has proven to be efficient and economical. Seabrook Farms, N. J., Lakeside Packing Co., Minn., and the Hanover Packing Co., Pa., use spray irrigation to dispose of their wastes. At Seabrook Farms it is reported (4) that as much as 100 inches of waste water has been continuously applied to wooded areas without causing ponding. On an adjacent plot of sandy loam soil covered with a good stand of crimson clover 2 inches of spray irrigation caused puddling and runoff. At Seabrook Farms some 200 acres are under spray irrigation; each acre is sprayed for 8 hours and then is allowed to rest for 24 hours. The dosage applied in one year to an area has been as much as 100 feet of waste water. Dairy processing plants, paper product mills (5), sugar beet factories, pharmaceutical plants and canneries are representative industries disposing of wastes by irrigation techniques.

Orange Products Plant—The Exchange Orange Products Company of Ontario, Calif., has to dispose of about 0.7 mgd of untreated wastes containing as high as 1,200 ppm sus-

(*Continued on page* 134)

● **INDUSTRIAL waste treatment and disposal at Exchange Products plant, showing the special furrows constructed to receive the waste which amounts to 0.7 mgd.**

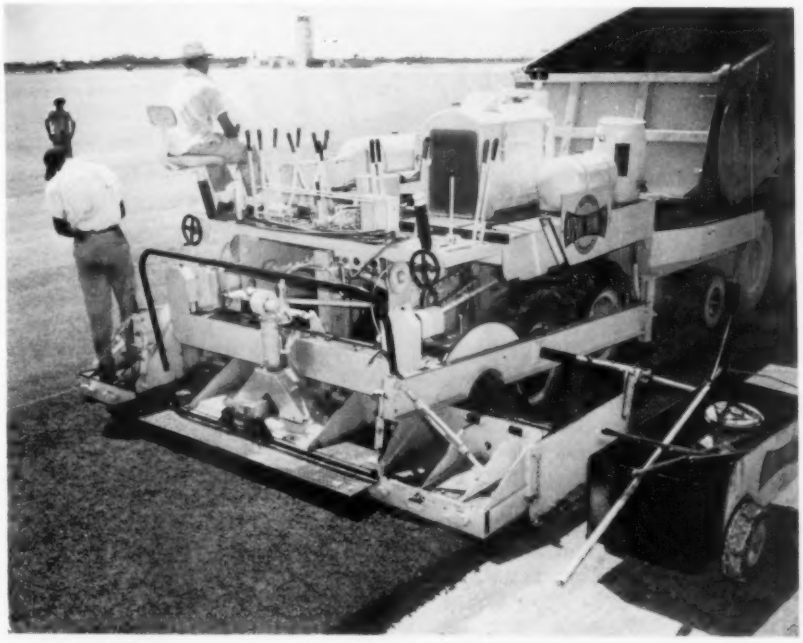
Tar Rubber and Asphaltic Concrete Placed for Jet Base Pavement

OVER 365,000 tons of asphaltic concrete and tar rubber will be required to surface the aprons and runways of the Homestead, Fla., Air Force Base. When completed this fall the jet field will have some of the longest runways in the world.

In addition to the large quantity of material being laid, an interesting feature of the paving job is the use of tar rubber, which is being furnished by the Naugatuck Chemical Co., Naugatuck, Conn. According to B. N. Gilmore, Manager of the Asphalt Paving Co., paving contractor on the work, this material is being used because it forms a surface which is not affected by jet fuel. Fuel spillage, a routine problem at jet bases, is extremely detrimental to standard specification asphaltic concrete, causing an accelerated deterioration of the mat.

For this reason, 1000 feet of each end of the runways and the entire surface of the aprons will be covered with a 1½-in surfacing of tar rubber. Remaining sections of the runways will be government specification asphaltic concrete. The runways are built on rock, covered with a 2½-in. compacted depth binder of asphalt and surfaced with asphaltic concrete except as noted above. A new PF-90 paver finisher, made by Blaw-Knox, is placing material at the rate of 200 tons per hour, top batch plant capacity, and laying an average of 48 feet per minute, 13 ft. wide. Commenting on the performance of the new paver, Mr. Gilmore said, "The main feature we like about it as paving contractors is that it lays an excellent mat at a high rate of speed."

Prime contractors for the Homestead Base are W. T. Price & Co., and Blythe Brothers, operating as joint contractors. All construction is under the supervision of the Jacksonville District of the U. S. Army Corps of Engineers of which Lt. Col. John S. Hassell is resident engineer.



● **TOP COURSE** of tar rubber, an inch and a half thick, is being laid on each 1,000 ft. at the ends of the runways and on the aprons to protect against jet fuel damage.

● **DAY STREET pumping station of the Montgomery Water Works. Pumps here are rated at 19.1 mgd against a head of 230 ft.**

New Wells

Assure Water for Montgomery

TO MEET the growing demand for water, Montgomery, Ala., undertook an expansion program in 1950 which was substantially completed last year. A specially created public service corporation was created, with the power to issue revenue bonds; and in the past five years, it has spent $3,300,000 to keep the city's water supply ahead of demand. This demand has arisen from a growing industry and a growing population; and, as in most other cities, a greater per capita use of water. Since 1950, population has increased from 106,525 to 118,500; and, in the same period, 20 new industries have been established in the city. Average water consumption increased from 10.7 mgd in 1950 to 14.5 mgd in 1954, or about 35 percent.

As a part of the program, five new wells were brought into service, capable of delivering 3.7 mgd of relatively soft and pure water. These wells, which are located in the West Montgomery field, vary in depth from 300 to 740 feet. They are equipped with 8-in. Fairbanks-Morse Pomona deep well turbine pumps and are connected to the Day St. pumping station by a 24-in. cast iron line. This line, which was extended 7800 feet to the new well area, is paralleled by 6,800 feet of new 30-in. cast iron main as it approaches the pumping plant.

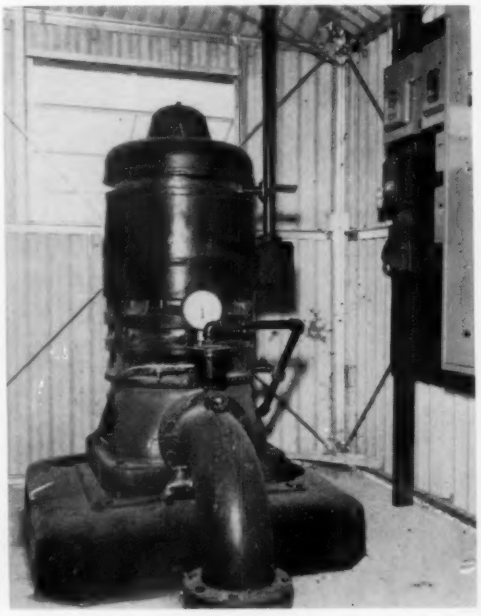
To assure future good service, five more wells are now or soon will be placed under construction. They will be located in the same vicinity and will be of the same general capacity as those recently completed.

The Pomona pumps installed in the new wells have semi-open 12-in. bronze impellers, which can be raised or lowered to adjust capacity. The impeller assemblies require no wearing rings and are free from sand locking. They are housed in bowls constructed of close-grained, high-tensile cast iron and are protected by strainers with area of openings far in excess of suction pipe area. The impellers are driven by oil-lubricated shafts, into which predetermined quantities of oil are fed by solenoid oilers. Each pump is driven directly by a Fairbanks-Morse motor, operating on 3-phase, 60-cycle current at 220/440 volts and 122/61 amps. Four of these motors are rated at 50 hp at 1170 rpm, while the fifth is rated at 75 hp at the same speed. The five motors are housed in pre-fabricated steel shelters, with all motor controls, transformers and circuit breakers mounted against an interior wall. A roving attendant makes periodic checks at each shelter but the pumps are actually started and stopped by means of remote controls from the Day Street station.

The water supplied by these five wells is checked constantly and has always been found free of harmful bacteria. It is reasonably soft, averaging 50-55 ppm hardness and has very little chlorine demand. About 2.4 ppm of chlorine is added at the Day Street station and a residual of about 0.4 ppm is generally found in the distribution system.

The location of the new wells was determined after a 3-year series of water surveys conducted in collaboration with the Department of

(*Continued on page* 118)



● **WELL 708 ft. deep is serviced by this F-M motor and 630-gpm pump.**

Another One?
Out or Down? Where?

JOHN GRAY,
County Engineer, Pendleton, Oregon

FOR MANY years the bridge program of Umatilla County lacked engineering direction and control. As a result, telephone conversations too often ran this way: "What? Another one? Out or down? Where? What number?" Following a reorganization some 18 months ago, the author was employed to remedy this situation.

First a County-wide survey or inventory, was made of all Umatilla County bridges to determine the location, physical dimensions, type of construction, physical properties, and general condition. This survey was made in conjunction with a larger survey determining the properties of all county roads, buildings, equipment, manpower, and rock production sites.

Results of this survey showed that the Umatilla County Road Department had 107 steel bridges with an H-10 rating or less; 23 concrete bridges of adequate design (these had been willed to the County Road Department by the Oregon State Highway Department in recent years by mutual agreement); and 549 untreated wood bridges with an H-Danger rating of varying degree.

The aggregate length of bridges needing replacement totaled approximately 14,000 linear feet. From this data it was then estimated that approximately $250,000 would be needed each year for a ten-year period to remove this one-a-week bad bridge problem and build bridges at new locations as needed. This figure, about 1½ times greater than the present Umatilla County Road Department bridge budget, points up our coming problems.

● **DOWN and out: What a D-7 dozer can do to an inadequate timber bridge.**

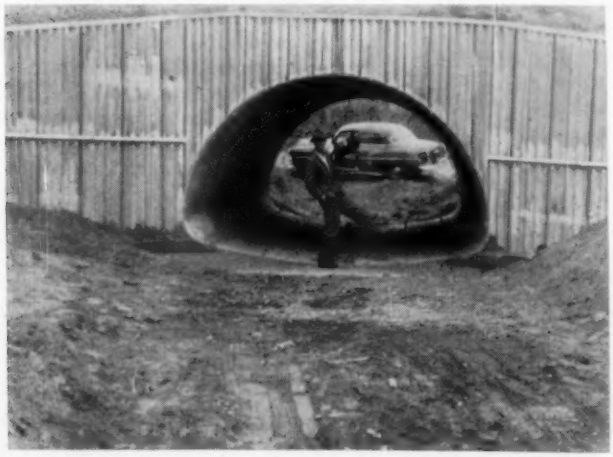
Materials, equipment, and trained manpower available to tackle this mammoth bridge replacement program were also inventoried and evaluated.

Our various surveys indicated a need for a controlled bridge replacement plan taking into account the following factors: (1) Engineering design for reasons of safety and economy; (2) Construction materials of steel, concrete, or treated wood for reasons of permanency; (3) Centralized purchasing for reasons of economy and scheduling of materials; (4) Supervision for proper guidance and control in the field.

As a result of this study, a long-range program was developed. In 18 months, this progress can be reported: As of July 1, 1955, 160 untreated wood bridges have been eliminated. These structures, ranging in roadway length up to 242 feet, have been replaced by corrugated metal pipe culvert, corrugated metal structural-plate pipe, concrete pipe, treated wood, or concrete and steel structures, as engineering design indicated. Most of the steel in the larger bridge replacements has come from our own large steel stockpile.

From these figures, it would appear that the bridge problem would soon be solved in Umatilla County. However, such is not the case for two reasons. These are—lack of increased funds and the fact that replacement of smaller structures has occurred first. Everyone recognizes the increased replacement cost problem which will increase with bridge span length.

However, this long range bridge program is destined for ultimate completion because the present Umatilla County Court, composed of Judge D. R. "Sam" Cook, Commissioners J. E. Olinger, and Roscoe H. Kelley, and the author are joined by the taxpayers of Umatilla County in a coordinated effort to cut taxation through bridge replacement by use of permanent type materials and good design.



● **MODERN replacement for an old and inadequate bridge. This modern and pleasing structure cost $6.93 per sq. ft.**

● **BRIDGE 20 ft. long and 22 ft. wide was built in ten days; total cost $4800. Piling was sunk to depth of 32 ft.**

Incineration in OHIO Cities

IN OHIO the use of incineration as a method of disposing of refuse is quite widespread, ranging from the largest Ohio city, Cleveland, to many small municipalities. Examples of the use of incineration in various-sized municipalities in Ohio are as follows:

Barberton—Prior to 1948 the city of Barberton (population 27,820) was served by a private collector for garbage from homes and commercial establishments. The city constructed an incinerator and placed it in operation in October, 1948.

The incinerator consists of two fifty-ton Pittsburgh-Des Moines hand-fired furnaces. It was built at a cost of $235,000 of which $70,000 was a bond issue inside the 10 mill limit with a retiring period of seven years at 1¾-percent interest.

Warren—For many years Warren (population 49,856) was confronted with the primary problem involving collection, storage and disposal of garbage, refuse and ashes. An open dump was used to dispose of garbage and refuse prior to 1951 when the city took its first corrective step by building a Morse Boulger, drive-in direct charge type of incinerator. The plant is equipped with two 97½-ton furnaces utilizing Beaumont-Birch charging and ash-discharging gates. Temperatures in the furnaces are maintained at an average of 1600 to 1800 degrees Fahrenheit. To destroy 50 to 55 tons of mixed garbage and refuse daily, no fuel other than dry combustible refuse is used. The plant is a cell-type manually stoked incinerator with a capacity of 195 tons per twenty-four hour period.

The incinerator is operated nine and one-half hours daily and six hours on Saturday. The Saturday operation uses only one furnace while the other is checked for minor maintenance repairs. Major repairs are made on Sunday.

To avoid congestion at the site, trucks are carefully scheduled in loading charging holes of furnaces. A fee of $2.50 is charged to private haulers. The Warren incinerator operates at an annual cost of $33,000 or an average of $2.50 per ton of refuse incinerated. The entire cost of the incinerator was $250,000 and was financed through the use of general obligation bonds.

Wyoming—The city of Wyoming (population 5,582) constructed its incinerator during the depression with the help of the government at a total cost to the city of less than $18,000. The design parallels the design of a Pittsburgh-Des Moines furnace. The city originated its own design in order to secure replacement castings at a lower cost. Burning eight hours daily the capacity of the plant is twenty tons per day. The entire operation is handled by one man.

Sidney—Sidney's incinerator was constructed in 1947 at a total cost of $124,826.83, financed by mortgage revenue bonds. This incinerator constructed by the Morse Boulger Destructor Company, has a daily capacity of sixty tons. It has a rotary stoker and is charged manually from the top. The refuse is dumped directly from the trucks to the charging floor. The plant is operated by two men, one of whom works only part time in the morning to help prepare the plant for the day's operation.

The annual cost of operation is $7,500 including wages of the operators. Sidney, with a population of 13,000, requires two routes in order to give the residential area weekly collections along with daily collections from commercial establishments.

Along with these garbage routes, the city also maintains a covered truck in collecting paper cartons and other inflammable refuse from the commercial district. This inflammable material is used to burn all garbage in the incinerator without the use of additional fuel.

Toledo—The city of Toledo (population 303,616) has two operating incinerators, one in the west section of the city and the other in the extreme east section. They were both put into operation in 1927.

The west side incinerator was constructed at a cost of $19,000 for the land, and $123,000 for the building, equipment and machinery.

The east side incinerator was constructed at a total cost of $118,705. Land cost was $10,605 and the building and equipment cost $108,100. Financing for both incinerators was handled through general obligation bonds. Engineering costs were absorbed by the city's engineering division.

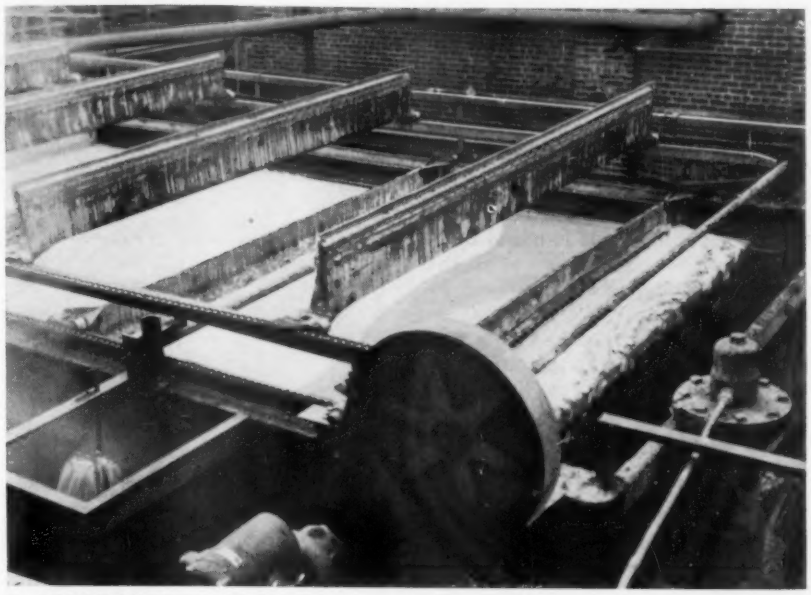
Each of the two plants was constructed for 100-ton capacity when new. Now, nearly thirty years later, their efficiency has diminished from the original 200 tons to approximately 135 to 140 tons daily.

Cleveland—The issuance of councilmanic bonds and a grant from the federal government (P.W.A..) enabled Cleveland (population 914,808)

(Continued on page 148)

PACKING WASTES TREATED AUTOMATICALLY

EDWARD G. ANDERSON,
Supt., Fats and Oils Department,
E. Kahn's Sons, Inc.



● **NEOPRENE-tipped flight scrapers push floating solids, grease and oil into recovery chamber at right. Speed of scrapers and amount of dip are adjustable.**

WASTE WATER disposal has traditionally been a headache to the meat packer. In the past, that was the case at E. Kahn's Sons, Inc., of Cincinnati, largest meat packer in Ohio and one of the most up-to-date installations in the country. About 1,000 head of cattle and 5,000 to 6,000 hogs are processed at this installation each week, along with a substantial number of calves and lambs. Some time ago, the company decided to look into some method of waste water treatment, largely because of high sewerage charges. Process water used at Kahn's is discharged directly into city sewers and charges are based on loading. Because of the substantial production at the plant and an average waste flow of 500,000 gal. per day, a high percentage of fats, grease and oil was discharged to the sewers each day. BOD content of the waste ranged from 2,000 for 2,500 ppm. and suspended solids from 1,200 to 1,400 ppm.

The company looked into several possible solutions to its problem, and four years ago selected the Colloidair unit, made by Bulkley, Dunton Processes, Inc. This system's operating principle is the use of chemical floc to break oil and water emulsions and coalesce solid particles, followed by a flotation accomplished by the release of dissolved air. Lastly, a mechanical system of flight scrapers skims off the floated solids and conveys them to a recovery chamber. The unit is virtually automatic. Here's how it works at Kahn's:

How the Plant Works

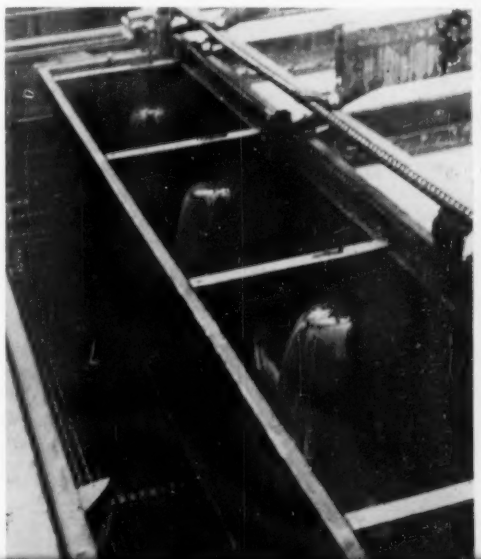
First, water from all phases of the packing house operation is passed through one or more of four preliminary catch basins and settling tanks situated throughout the plant. Each of these has a capacity of 1,500 to 2,000 gals. Flow is continuous with an average detention time of about 5 minutes in the preliminary basins. From these preliminary catch basins the waste effluent flows to a main catch basin which, with a capacity of about 10,000 gals., provides a detention of 10 to 12 minutes.

After this final settling and flotation, the effluent is pumped through a flow control to a closed retention or dwell tank which is divided into two sections by a vertical baffle plate. The functions of this tank are to insure air saturation, to complete flocculation and to remove excess air. This excess air is released and bled from the closed tank as the water passes over the baffle. At the same time, the desired pressure is maintained, regardless of flow variations, by an automatic, air-operated control valve at the separator inlet. Pressure on the retention tank is about 35 psi.

At this point, alum is injected from a chemical feed system to coagulate the waste. Stock solution is 1 pound of alum to 1 gallon of water. Feed varies from 30 to 50 gals. per hour depending on the characteristics of the influent. Following addition of the alum solution, the flow is passed into a degasification and stilling chamber where it is distributed across the top of the inlet section of the flotation tank at a predetermined level. From the time the effluent leaves the control valve, all process steps are visible; that is, the chemical flocculation, the degasification, the particle separation (and fat collection), the suspensoid float collection, the positive removal and compaction of the float mat on the recovery apron, and the discharge of the clarified effluent, all can be seen.

Flotation is accomplished by release of the air from solution in water and its physical attachment to the flocculated particles. The buoyancy of the minute air bubbles has the effect of lowering the speci-

(*Continued on page* 134)



● **A CLOSE-UP view of clarified water recovery tubes. Note clarity as compared with untreated material at right.**

AIRPHOTO INTERPRETATION - - - AN AID *in* MATERIALS *and* ROUTE LOCATIONS

D. R. LUEDER,

Chief, Engineering Soils Section

Photographic Survey Corporation

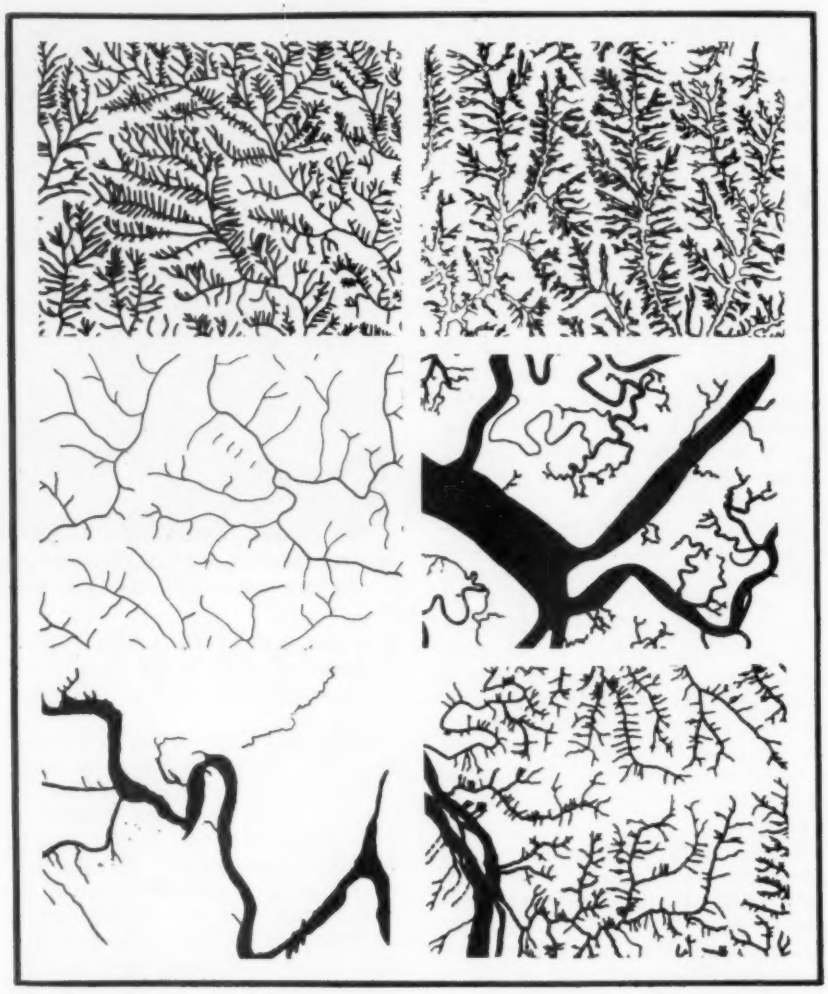
A CONCISE definition of airphoto interpretation is difficult. It is most convenient to define it by means of three explanatory statements: 1) It is based upon a stereoscopic examination of all the features shown on an airphoto; 2) It depends upon deductive and inductive evaluation of these features in terms of common sense and field experience, supported by the interpreter's photo experience and his academic and practical background; and 3) It reveals qualitative information on the type and characteristics of the rocks, soils and water conditions in a given area.

At the most common available scale (1:20000) a 9" x 9" aerial photograph shows an area of nine square miles. At this scale, the photographs register those significant surface features that would be visible to a field engineer; and they show all of the features at one time —in their true relation to each other —not one side only of the ridge or one view of a drainageway. In addition, the photographs register indications of many features that are normally invisible on the ground—subsurface drainage, faint tone changes, impeded drainage, etc.

It is apparent that if such a photo is examined by an experienced interpreter—one able to evaluate the significance of the various features shown—a relatively inexpensive and efficient means is provided for the collection of preliminary planning information, the formulation of field sampling attacks and the location of construction materials.

Successful interpretation is dependent upon the integrated evaluation of all the significant features registered on the photographic print. These significant features include two or more of the following: Landform patterns; surface drainage patterns; gray tone patterns; erosion patterns; and miscellaneous details of vegetation, micro-indications, culture and boundary characteristics.

In general, interpretation is accomplished by separately evaluating the indicative significance of each pattern and then combining all indications to reach conclusions regarding the qualitative characteristics of the area being studied. The final conclusions are most important when they are supported by a "coincidence of evidence."



● **TYPICAL drainage patterns reveal (left column) arid shale, humid shale and arid sandstone; (right column) subhumid loess, tidal marsh and gneiss and schist.**

Landform is a specific term that refers to a terrain feature— or terrain habit—formed by nature in such a way that it may be considered as a unit, and described in terms of typical, individual, repetitive characteristics. Wherever it may occur in the world, a landform should be recognizable in terms of its typical characteristics, by one who is familiar with them. Some common landforms are sand-dunes, terraces, alluvial fans and stream flood-plains. Many people are able to recognize landforms; to obtain practical information, such an evaluation is not enough.

Speaking from the standpoint of the materials or location engineer, it is not sufficient to call a terrace a terrace. Information is desired concerning its composition—gravel, sand or silt. It is not enough to know that an area includes tilted sedimentary rocks. It is important that they be identified according to type—clay shale, sandy shale, sandstone, limestone or interbedded types. It is important that the location engineer know that some portions of a glacial till plain are composed of poorly drained clay, others of a well-

(*Continued on page* 140)

APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Highlights of the 1955 Congress and Equipment Show

NEARLY 2,000 persons, representing different segments of the public works industry attended the 61st Annual Meeting of the American Public Works Association in Milwaukee, Wisconsin, October 2-5. The four-day meeting featured a large display of the newest types of equipment used in the public works field and many technical sessions where delegates exchanged views on a wide variety of subjects.

At annual meeting of the membership various committee reports were presented and the results of the election of officers was announced which placed Edward P. Decher, Secretary of the Joint Sewer Commission of Newark, at the helm of this fast growing organization. The new president, who succeeds Warren A. Coolidge, Director of Public Works, Nashville, Tennessee is one of the founders and past presidents of the Association's New York-New Jersey Metropolitan Chapter. Other newly elected officers were: Kenneth K. King, Director of Public Works, Phoenix, Arizona, re-elected Western Area Vice-President; Frederick W. Crane, General Manager, Buffalo (N.Y.) Sewer Authority, Eastern Area Vice-President; Robert L. Anderson, Superintendent of Public Works, Winnetka, Illinois, re-elected Treasurer; and Jean L. Vincenz, Director of Public Works, San Diego County, California and Sol Ellenson, Director of Public Works of Newport News, Va., who were elected to serve two-year terms on the Board of Directors.

Other highlights of the opening day's meeting were three concurrent forums. Each of these were preceded by a technical paper. One, covering civil defense was presented by E. L. Knebes, Assistant City Engineer of Milwaukee. Professor Earnest Boyce, chairman of the department of civil engineering of the University of Michigan, Ann Arbor, in his prepared paper, said that—"there is a need to constantly explore and re-examine the present solution of public works problems in the light of advancing knowledge of science and its many possible applications." Dr. Louis McCabe, scientist director of the U. S. Public Health Service, outlined plans by federal agencies for research and study of air pollution problems as authorized by Public Law 159, passed by the 84th Congress.

Many specifications for public works equipment "stop at a point that amounts to nothing more than a straight copy of a dealer's catalog," the Deputy Purchasing Agent of Chicago told the annual Congress. Public Works officials heard Richard B. Berry explain that the award of a contract to a dealer or manufacturer meeting such a specification on the low dollar price may not be a good measure of the low cost. The specification, he said, "may not reflect durability, or a measure of the life and efficiency of the unity; it may not be a full measure of the productivity, the number of units performed in a unit of time; dependability may not be reflected directly or how much down-time or loss of productivity you may have; nor may it truly tell about the time or labor saving features, where possibly you need three operators per machine as compared to only one of another type of machine."

Chicago has made some encouraging progress according to Mr. Berry, in developing procedures which will enable the city to evaluate these important factors and to buy its equipment on a low-cost rather than a low-price basis.

Mr. Berry's paper on "Procurement" was one of three presented at a forum on "Equipment Management". Others presented were "Utilization" by Ray Blessing, Commissioner of Streets and Sewers of Kansas City, Missouri, and "Maintenance" by W. W. Rote, Superintendent of Mechanical maintenance for the Department of Public Works of Phoenix, Arizona.

Public works projects can be completed in less time and at lower costs by more careful preparation of contract documents, according to Milton F. Wagnitz, City Engineer for the City of Detroit.

A thorough review of the manner and methods of preparing contract documents should be made and many outmoded and unnecessary procedures would undoubtedly come to light. Efforts devoted to this task would save both time and money by eliminating uncertainties in the bidder's mind. This viewpoint was expressed in a paper on "Contract Documents" presented by Mr. Wagnitz at a forum on "Construction Contract Administration." Other papers presented at this forum were "Award Procedures" by Harral, Street Commissioner for Philadelphia, and "Inspection and Testing" by W. T. Anderson, Inspector of Public Works of Los Angeles.

L. P. Staman, director of public works of Tacoma, Washington stated that pavements in U. S. Streets is cut open for installation

(*Continued on next page*)

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NY Metropolitan Chapter Visits Harbor Facilities

A tour of the harbor facilities of the New York City area was greatly enjoyed by members and guests of the New York-New Jersey Metropolitan Chapter at the Fall meeting of the chapter on September 28. During the boat trip, sponsored by the Port of New York Authority, the group inspected many miles of shipping facilities on the Manhattan, Brooklyn, Staten Island and New Jersey waterfront, with a stop at Port Newark to observe cargo handling techniques. Though postponed from the date originally scheduled by the threat of Hurricane Ione, the marine tour was well attended.

Dinner at the Downtown Athletic Club was preceded by a cocktail party arranged through the courtesy of Gar Wood Industries. Highlights of the dinner meeting was presentation of the Chapter's Award of Merit to Commissioner Andrew W. Mulrain of the New York City Department of Sanitation. Chapter officers elected for the coming year are: President, Francis Klaess, Superintendent of Public Works, Rockville Centre, N. Y.; Vice-President, Harold Fredericks, Asst. Town Engineer, Irvington, N. J.; Secretary, William Foster, Engineering Editor, "American City Magazine"; Treasurer, John J. Baffa, Consulting Engineer, New York City. Others elected to serve on the Board of Directors are Casimir Rogus, Director of Engineering, Department of Sanitation, New York City and August E. Zentgraf, Bureau of Sanitation, Newark, N. J. Andrew Eschenfelder, Borough Engineer of Glen Ridge, N. J., is immediate past president.

● CHAPTER PRESIDENT Andrew Eschenfelder presents an Award of Merit to Commissioner Andrew W. Mulrain at the New York-New Jersey Metropolitan meeting.

• • •

Milwaukee Congress

(*Continued from preceding page*)

or repair of some underground utility to the tune of $61 million a year. His paper on "Planning and Coordination" was presented at a forum on "Sub-Surface Utility Regulation and Coordination." Others presented were "Regulation and En-

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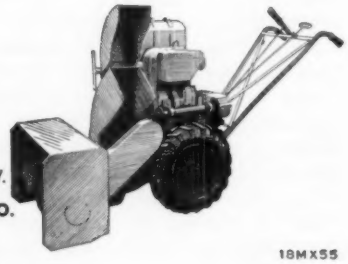

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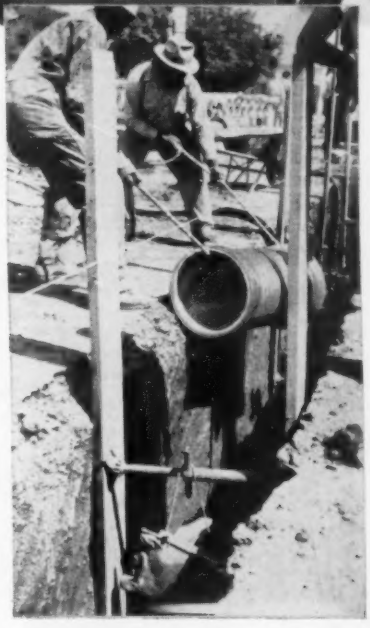

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forcement" by John A. Morin, Superintendent of streets and exofficio city engineer, Oakland, Calif., and "Street Restoration Procedures" by Leo F. Flotron, chief engineer of highways, Dayton, Ohio.

The second morning of the Congress consisted of sixteen concurrent question and answer sessions covering a wide variety of topics; such as, storm and sanitary sewers, street maintenance, public relations, etc. These were again held as a traditional feature of the meeting. The afternoon session on the second day featured three papers. The first was titled—"Public Works Policies For Boom or Bust" was presented by Dr. Harld C. Taylor, Director of the Upjohn Institute for Community Research. This Institute, which is located in Kalamazoo, Michigan is a privately sponsored non-profit organization which was established ten years ago to do research on the causes and effects of unemployment and on ways to avoid or cope with unemployment. Dr. Taylor said that there has developed a fairly widespread notion since the middle thirties that public works expenditures might be juggled within a business cycle in such a way as to provide a rather useful balance wheel. However, an extensive study conducted by the Institute led him and his associates to the conclusion that "the arguments for building public works in any other way than as needed are not very convincing."

Other papers presented at this general session were: "Apprentice Training and the Manpower Problem" by Fred W. Erhard, Assistant Director, Bureau of Apprenticeship, U. S. Department of Labor, Washington, D.C., and "The Administrative Manual—A Tool of Management" by John Craig Oliver, City Engineer of Vancouver, B.C.

The last day of the Congress included the presentation of papers by two federal officials and a case study on developing a refuse collection program. David R. Levin, Chief, Land Studies Section of the U. S. Bureau of Public Roads said that "the express way is the best single answer to the problem of restoring accessibility to urban areas, large and small, by making it possible to move large volumes of motorized vehicles safely and efficiently." One way, he said, of making sure that we have the lands we will need for efficient transportation facilities in the reasonable future is to purchase them now from a revolving fund which is reimbursed from highway funds when projects are programmed for construction. California highway officials estimate that a savings of $5 has been effected for every dollar that has thus far been invested in the advance acquisition of highway rights-of-way. The States of Washington, Ohio and Wisconsin, he said, have also established special funds for purchasing right-of-way in order to prevent private construction, on land which is expected to be needed for highway construction in the reasonably near future. Mr. Levin suggested that serious consideration be given to the possibility of eliminating many of the intersections which are a constant source of difficulty.

Malcomb C. Hope, Chief of the U. S. Public Health Services General Engineering Program, said, in his paper titled—"Public Works and Community Health", that "A principle solution to our problem of safe and sufficient water lies in the treatment of water which has been used by cities and industries, so that it may be re-used as it flows from

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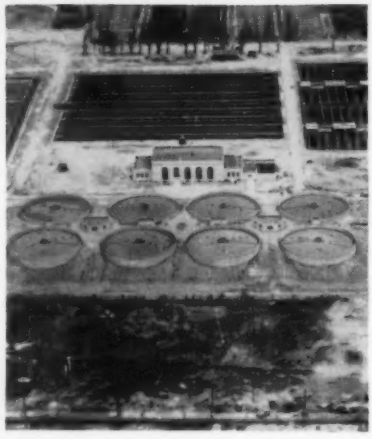

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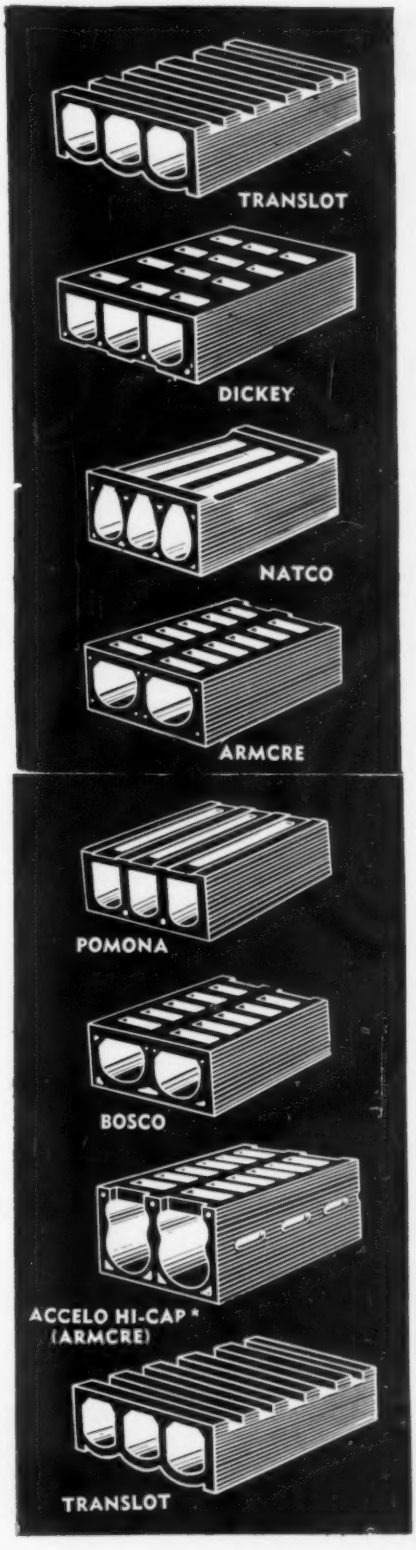

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Consider what this versatility can mean on your city landfill and maintenance programs. Get all the facts . . . write, or ask your LeTourneau-Westinghouse Distributor about high-speed, electric-control D Tournapulls TODAY!

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city to city and from state to state." To the inadequate or no treatment of sewage from more than 60 million urban population must be added the polluting wastes from industry which are equivalent to the sewage load from an estimated 110 million people. Expenditures of from 350 million to 500 million dollars annually for a 10 year period, he said, would be required to eliminate the backlog of needs set at 8,300 new plants or major additions and to take care of the new requirements resulting from population growths and plant obsolescence.

The case study on developing or modernizing a refuse collection program was presented by J. Henry L. Giles, Sanitary Engineer of Hartford, Conn. Eight of the nation's top-ranking municipal sanitation officials from New York, Philadelphia, Chicago, Cincinnati, Washington, D.C., Rochester, Los Angeles, and Winnipeg, Canada participated in the case study discussion. The afternoon of the final day was devoted to a series of inspection trips to Milwaukee's water purification, sewage treatment and incineration plants.

The annual dinner marked the end of the 1955 meeting which, attendance-wise, surpassed all previous records. Thirty-five members received the Samuel A. Greeley Service Award in recognition of 30 or more years of faithful service to their respective cities. Robert L. Anderson, Superintendent of Public Works and Village Engineer of Winnetka, Illinois received the Charles Walter Nichols Award consisting of an honorarium of $500 and a scroll describing his achievements. The award was presented for his outstanding leadership in the field of municipal sanitation. Melvin Jack Shelley, of Vancouver, Canada was named the first recipient of the Engineering News Record Fellowship for advanced study in the field of public works engineering and administration. He is a graduate civil engineer of the University of British Columbia. The citation accompanying the $1,000 Fellowship stated that the award was presented—"in recognition of his demonstrated technical abilities, on-the-job performance (while employed by the city of Vernon, Canada), desire and scholastic capacity for graduate study and personal qualities particularly fitting for a career in public service."

Edward P. Decher, Secretary of the Joint Sewer Commission of Newark, New Jersey was installed as the new president of the Association at the close of the dinner meeting.

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PUBLIC WORKS DIGESTS

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Long-Range Effect of Air Pollution

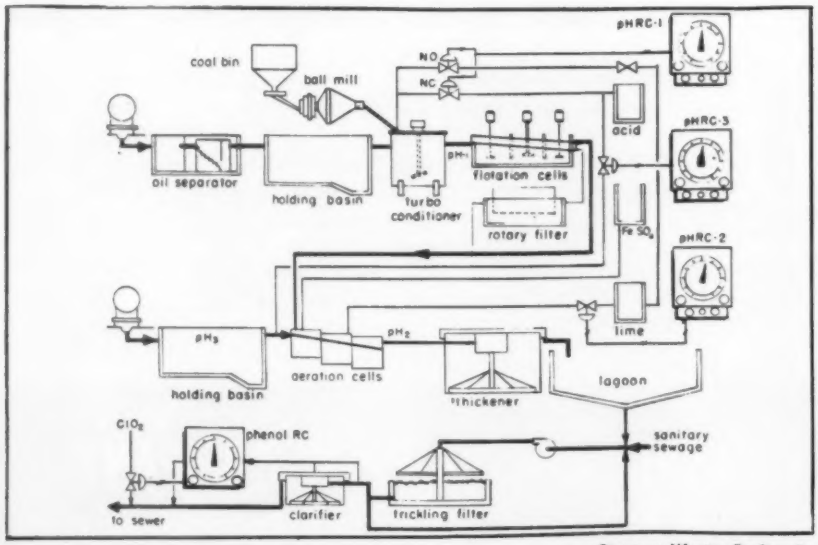
Air masses have physical structures analogous to those of streams and lakes, and exhibit flow characteristics, stratification, turbulence and other dynamic phenomena interpretable by analogy with the movements of water. Substances discharged into air are subject to gravitational, thermal, electrical, and chemical stresses of the same types as those operative in streams; only biological processes are notably absent in air. Likewise flow of the air stream can cease entirely, and concentrations of pollutants can be built up to produce mass irritating effects in metropolitan areas. Considerable evidence of the persistence of pollutants in large air masses has been developed from observation of volcanic dust clouds, smoke from forest fires, and more recently, from the dispersal of radioactive substances. That pollution can persist nationwide, and even worldwide, for long periods of time is unquestioned. Chemical interactions, often energized by solar radiation, occur among pollutants. These may result in the formation of substances either more or less objectionable than the original effluents. In certain local situations photochemical processes are believed to be principal sources of eye irritants, odors, damage to vegetation and the deterioration of rubber. Generally, the air mass can be said to be self-cleansing, but definite information is lacking on the extent to which the air may accommodate the waste products of man's activity.

"The Long-Range Effect of Industrial Air Pollution on the Purity of Air Masses Nationwide—Is the Mass Self-Cleaning?", By Leslie A. Chambers, Ph.D., Robert A. Taft Sanitary Engineering Center. *Proceedings, Industrial Session, Texas Water and Sewage Works Association's Short School, 1955.*

Treating Meat Processing Wastes

The H. H. Meyer Packing Co. of Cincinnati, O. processes pork products at the rate of about 1200 hogs a day. The several hundred thousand gallons of water produced per day were originally discharged to the city sewers; but to reduce the sewage charges, which are based on loading, the company in 1954 began treating the wastes. They are pumped to a large settling chamber, where solids are removed from the bottom and grease from the top; about 75% of the total grease and fat content being so removed. The effluent is then treated by dissolved air flotation. The unit removes about 80% of the grease fed into it and about 90% of the suspended solids.

"Meat Packer Tucks Wastes Unit in Abandoned Wine Cellar." By Gordon A. Meyer, *Wastes Engineering*, September.



Courtesy Wastes Engineering

● **FLOW DIAGRAM of treatment plant for tank car wastes.** **See page 114.**

Determining Smog Characteristics

The presence of organic peroxides produced by the reaction of ozone and volatile unsaturated hydrocarbons is believed to be one of the damaging characteristics of the Los Angeles basin smog. Short-chain organic peroxides have been found but no analytical procedure has been available to identify the longer-chain peroxides in the atmosphere. A 20% buffered potassium iodide solution measures atmospheric ozone, nitrogen dioxide, and some peroxides. A ferrous thiocyanate reagent previously used is not nearly so sensitive to ozone as other reagents and is useful in measuring other atmospheric oxidants present in minute amounts. A modification of the Wagner ferrous thiocyanate method was tried. It involved the addition of ferrous ammonium sulfate to an acidified solution of ammonium thiocyanate and reading of the color development with an electrophotometer, using a 425-mμ filter. A standard curve was prepared by adding known amounts of ferric iron to the reagent. Experiments were undertaken to evaluate the method in detecting reactions between controlled amounts of ozone and hexene. The thiocyanate reagent value was much higher after hexene was added indicating that ozonated intermediates were present, presumably peroxides. The reverse was true upon the application of the buffered potassium iodide reagent. The experiment was repeated using gasoline as the hydrocarbon

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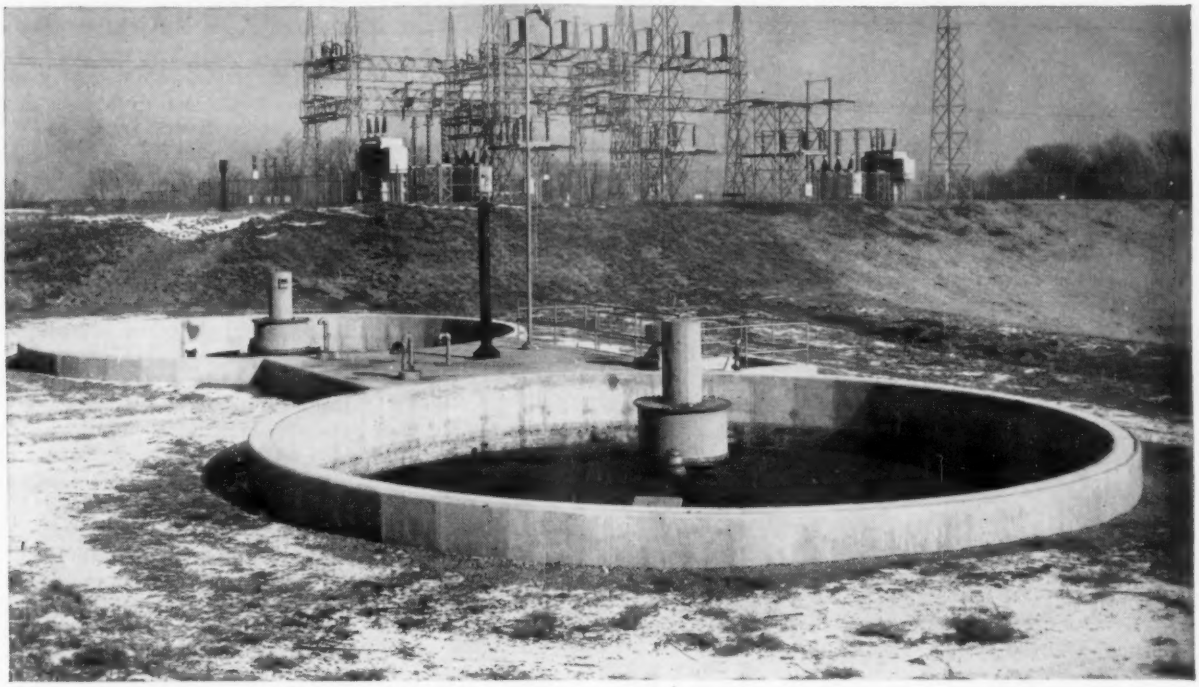

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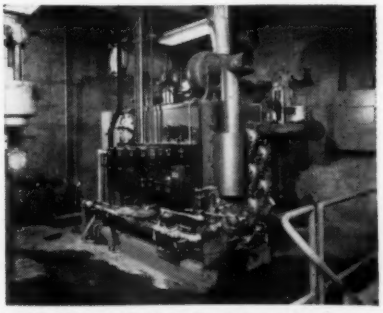
Completed in 1954, Eli Lilly's modern pharmaceutical plant at Lafayette, Indiana contains a complete waste treatment system for its antibiotic broth wastes, process wash, floor wash and sanitary wastes. An integral part of this highly flexible plant is the PFT "Controlled Digestion" system with provision for direct discharge of the concentrated antibiotic waste to the digesters.

A PFT Floating Cover is installed in each of the two 40′ diameter digesters.



PFT Heater & Heat Exchanger in the underground Control Building.

Floating Covers accelerate digestion and provide positive scum submergence while actually simplifying operations. Because no fixed levels need be maintained, additions and withdrawals can be made at times best suited to the overall operation. Near the covers, a *PFT Waste Gas Burner* burns excess gas and avoids odor nuisance.

In the underground Control Room, a *PFT Heater & Heat Exchanger* unit maintains close temperature control in the digesters *automatically*. Fired by gas *or* oil, the unit cuts fuel costs by utilizing all gas produced in the digesters.

Also in the Control Room are two *PFT Supernatant Liquor Selectors* (with Gauge, Sight Glass & Sampler) and a complete set of *PFT Gas Safety Equipment*.

The PFT Kraus nitrification process is included to assure proper functioning of the trickling filter system with waste which may be deficient in nitrogen.

PFT assisted consulting engineers by showing the adaptability of its processes and equipment in meeting the specific waste treatment requirements of this plant. To further assure successful treatment, PFT instructed plant personnel in the proper operation of its equipment.

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with similar results. Additional studies were performed applying the method under natural conditions of atmospheric pollution. Parallel increases of iodine released from buffered potassium iodide solution and reagent value of the ferrous thiocyanate occurred with decreased visibility. This indicates that when the amount of oxidant present increases, the amounts of substances giving reaction to the thiocyanate reagent also show an increase, probably being dependent on the amount of hydrocarbons present.

"Modification of Ferrous Thiocyanate Colorimetric Method for Determination of Some Atmospheric Oxidants." By Glenn A. Todd, Department of Plant Biochemistry, University of California. *Analytical Chemistry,* September.

Phenols Removed By Adsorption and Oxidation

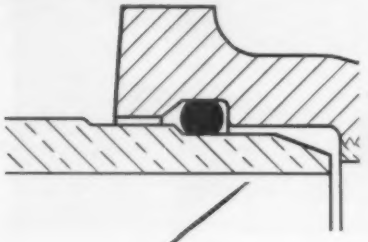
The General American Transportation Corp. operates more than 47,500 railway tank cars to haul petroleum products and numerous other liquids. In cleaning these between hauls, wash waters are discharged which often contain phenols. At Saegerstown, Pa. free soluble oils and fats are removed mechanically and the aqueous underflow is stored in a basin to equalize the flow and then pumped to mixing tanks. Here finely ground coal is mixed with the wastes and the pH is adjusted automatically to 4.5. As the coal adsorbs oils and phenols it becomes water-repellent. The coal and liquid wastes flow to a series of Turbo flotation cells where a frothing agent and air are added. The foam containing all the solids is scraped off, dewatered on a rotary drum filter, dried and burned as fuel. The effluent from this, combined with all other liquid wastes are mixed with sufficient ferrous sulfate to form a tough floc; lime is added to give a pH of 6.5-7.0 for optimum biological treatment, and the wastes flow to a Dorr sludge thickener, where the sludge settles to the bottom and the clear liquid wastes flow to a lagoon affording five days retention to prevent slugs of toxic liquids reaching the filter. The wastes are then mixed with sanitary sewage and pumped to a trickling filter. The effluent from the filter is clarified and sterilized with chlorine dioxide. The final effluent contains no toxic or taste producing substances. The entire plant operates automatically. Acid and lime feeding rates are controlled by electronic pH recorders equipped with Air-O-Line controllers, which feed either acid or lime slurry, as required to maintain the pH at 4.5.

"Phenol Wastes Treated by Coal Adsorption and Oxidation." By G. Gutzeit and Glenn A. Enyart. *Wastes Engineering,* September.

Index Organisms for Stream Pollution

Aquatic life is an intricate system in constant equilibrium if there is nothing on hand which can upset or disrupt this balance. By obtaining the services of an aquatic biologist the effects of pollution through studying the changes in this balanced system can be determined. A detailed interpretation of an aquatic system that has become changed or unbalanced by a pollutant would, of course, require the help of more trained personnel than are discussed in this paper.

Laboratory research plays a vital part in determining the toxicity of various wastes toward aquatic fauna. Fowler began a culture of daphnids and used these animals in the testing of many inorganic chemicals. Fairchild designed and utilized an apparatus in which he measured the effects of lowered oxygen tension on the susceptibility of *Daphna magna* to certain inorganic salts. A



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Installation is easy and simple. Unskilled workmen can make up the connection quickly and economically. No special fittings nor extra joint materials are required. The joint is tight against low or high pressure. For full information, wire or write

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study is underway to determine the effects of various inorganic salts on the reproduction of this same crustacean. The sunfish, *Lepomis macochirus*, and the daphnids are used as bio-assay organisms in measuring the potency of refinery wastes, insecticides, herbicides, paper mill wastes and oil field brines. By use of such entirely different organisms some insight is gained as to what is happening in the stream's biodynamic cycle.

Other index organisms used in Louisiana stream pollution surveys are annelids, sphaerotilus, rat-tail maggots, pulmonate snails, mayfly and dragon fly naiads, chironomids and clams.

"Index Organisms Used in Louisiana Stream Pollution Surveys"—by F. J. Coogan, K. E. Biglane, and R. A. Lafleur, Louisiana Wild Life and Fisheries Comm. *Proceedings, Industrial Session, Texas Water & Sewage Works Assn's. Short School, 1955.*

Coliform Bacteria In an Estuary

The concentration of coliform bacteria in an estuary is determined by: the rate of supply in the sewage effluent, the rate of circulation of fresh and salt waters in the estuary, and the batericidal action of sea water and other biological processes causing their death and disappearance. The distribution of fresh and salt water can be determined from a salinity survey of the estuary. The effect of circulation on a pollutant can be derived from such a survey for various locations of the outfall. The average concentration of pollutant (C_o) in a complete cross section of the estuary at the outfall is given by: $C_o = \frac{P}{R} - f_o$ where P is the rate of discharge of pollutant, R is river flow, and f_o is average fraction of fresh water in the cross section. Below the outfall, distribution of pollutant will be proportional to distribution of fresh water. For any downstream location (y), average distribution is $C_y = C_o \frac{f_y}{f_o}$. Above the outfall the distribution of pollutant will be proportional to the distribution of salt water. At any upstream location (z), the average distribution of pollutant is $C_z = C_o \frac{S_z}{S_o} = C_o \frac{(1-f_z)}{(1-f_o)}$ where S_o and S_z is the fraction of salt water at outfall and upstream location respec-

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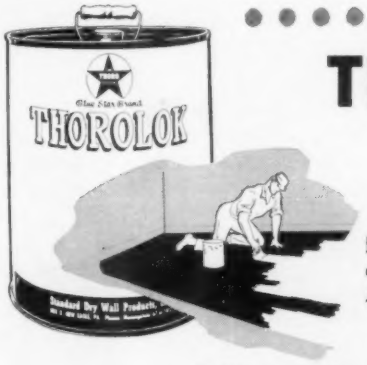

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tively. Many pollutants decay with time and prediction of their distribution is less certain due to several additional variables to be considered. The decay of such pollutants with time can generally be expressed by an exponential relationship $C_t = C_o e^{-kt}$ where C_o and C_t are the concentrations originally at time t, and k is the coefficient of the rate of decay. In the estuary, this decay is superimposed on the dilution produced by the circulation. The ratio between the concentration resulting from both processes (C_n) and the concentration expected as a result of circulation alone (C_y) is given by $\frac{C_n}{C_y} = \left(\frac{r}{1-(1-r)^{ek}}\right)^n$ where n is a segment of the estuary limited by the mean excursion of the water on the flood tide, and r is the mean exchange ratio of the segments between this location and the outfall.

"The Distribution of Coliform Bacteria and Other Pollutants in Tidal Estuaries", by Bostwick H. Ketchum, Woods Hole Oceanographic Institution. *Proceedings, Industrial Session, Texas Water and Sewage Works Assn's. Short School, 1955.*

Sludge Treatment

There is considerable background of experience for conditioning and dewatering sludge produced from sanitary sewage, and design and operating data available from this field are applicable for the treatment of industrial sludge. However, the character and composition of industrial sludge are such that it may not always respond to the same form of processing; consequently, pilot plant studies are often required to determine treatability, relative reliability, and operating costs. The capital investment in equipment and handling often represents a large part of the total cost of the treatment works, varying from 20 to 30%. The composition of sludge from treatment works varies widely and influences the type and design of the facilities which should be provided. Because fluid sludge contains 90 to 95% water, or even more, maximum concentration of the solids is desired. In the wet state, both digested and undigested sludges are fluid and flow by gravity or can be pumped. The purpose of dewatering all types of sludges is to shrink the volume of the material for cheaper and easier disposal, as well as to permit ultimate disposal without creating local nuisances, odors, flies, or unsightly areas. If dewatering is to be achieved by various devices it is necessary to determine the volume of semi or fully dried sludge which must ultimately be disposed of. The reduction in the volume of sludge resulting from dewatering can be calculated by: $V^1 = V(1-P)/1-P^1$ where V is the volume of digested sludge; V^1 is the volume of dried sludge; P is the percentage of moisture in the digested sludge; and P^1 is the percentage of moisture in the dried sludge. The degree of dewatering required has an important bearing on the selection of facilities to be provided. The several conventional methods for drying sludge applicable for both sanitary and industrial wastes are: Lagooning; drying beds; vacuum and pressure filters; flash and drum drying; and incinerators.

"Dewatering and Disposal of Sanitary and Industrial Waste Sludge Involve Perplexing Engineering Problems", by Sheppard T. Powell, *Industrial & Engineering Chemistry*, September 1955.

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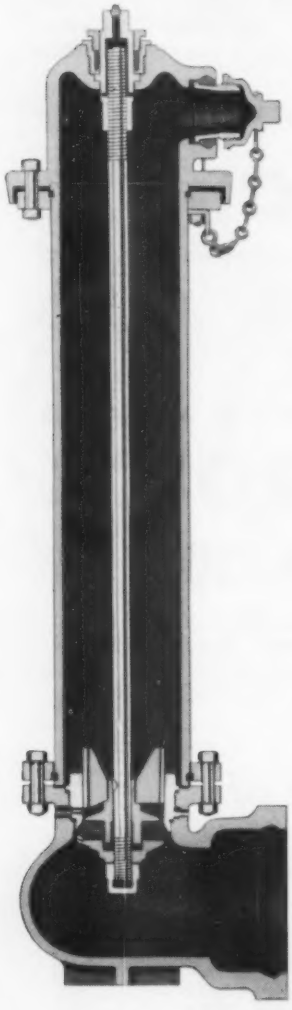

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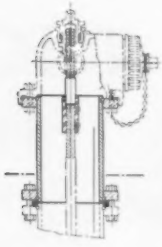

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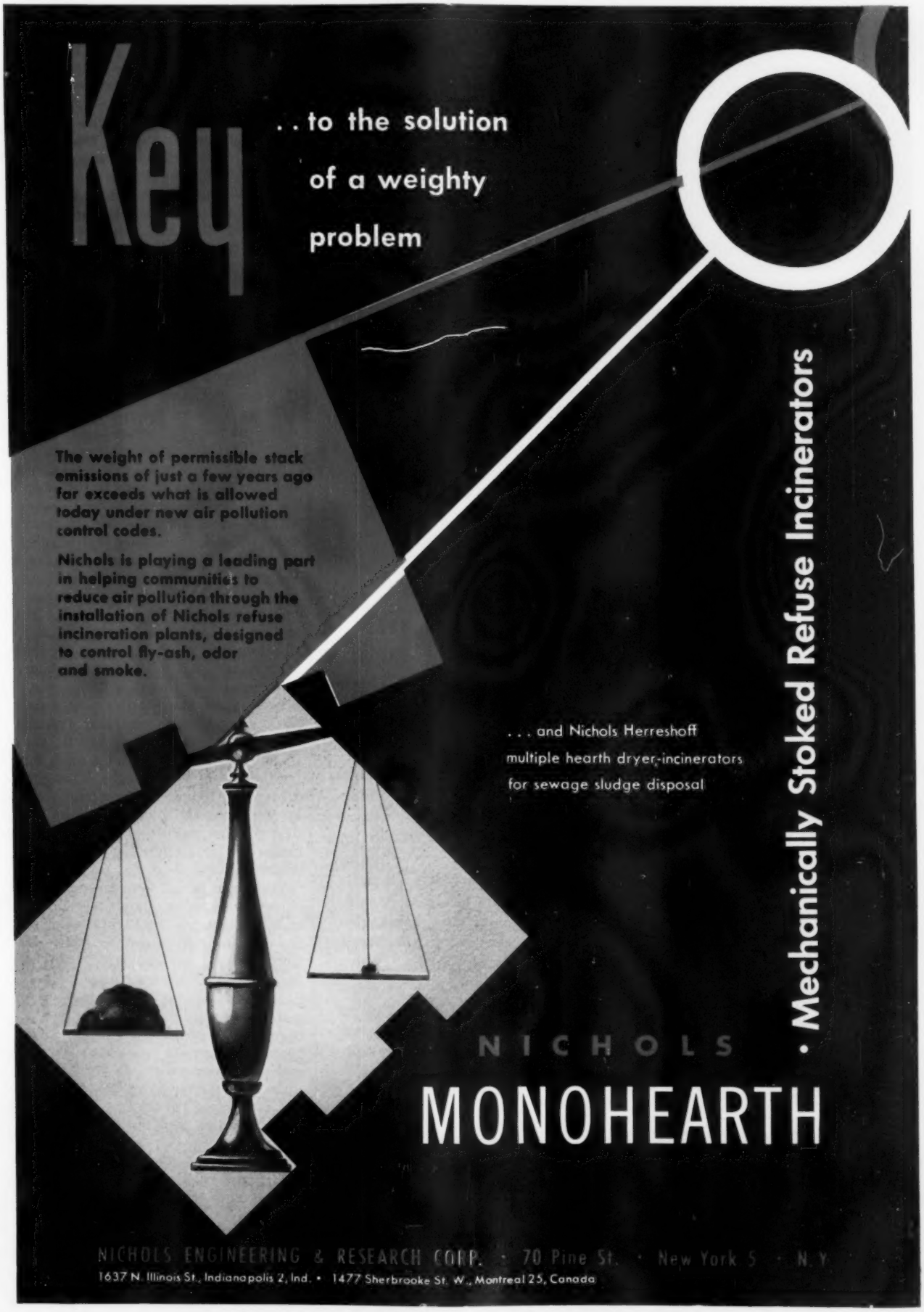
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Picking Up the Pieces After "Hurricane Hazel"

MYRTLE BEACH, SOUTH CAROLINA—Necessary repair work after a recent hurricane included: (1) Build a sand bank to save the shoreline. (2) Gather and load sand to re-build roads. (3) Bulldoze new roadbeds. (4) General cleanup. All of this heavy work was in soft, shifting sand.

A husky Sherman Front End Loader, mounted on the economical Fordson Major Diesel Tractor, finished these jobs in record time. "Tailor-made" for Fordson Major wheelbase and tread, this loader features proper distribution of weight and loading stresses and gives the best traction in "rough going." A full-length mounting sub-frame reinforces the entire tractor and minimizes the effect of strain and shock. Rear axle supports reduce side sway when loading or carrying, making the entire unit more rigid. This eliminates side slippage when dozing or filling the bucket, also lets the bucket be filled with less power and less strain on clutch, steering gear and operator.

Various attachments adapt the Sherman Front End Loader to many earth-moving, excavating and loading jobs. Two models available . . . up to 2500 pounds bucket and 4500 pounds breakaway capacities. Ask your Ford Tractor Dealer for a demonstration, or write us for Bulletin 524.

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New Wells for Montgomery

(*Continued from page* 100)

the Interior. These surveys showed that the West Montgomery field, which supplies two-thirds of the city's total water supply, and where 26 of the city's 42 wells are located, is capable of providing an additional 10 to 15 mgd when needed. This is over and above the 3.7 mgd provided by the five new wells and should be sufficient to meet all requirements for several years to come. However, as the number of wells in the west field increases, the Day Street pumping station, which has a capacity of 19.1 mgd, will have either to be expanded or a new pumping station built. If this is done, the new plant will probably be built on the southeast perimeter of the city, about seven miles from the Day Street station.

Water from the West Montgomery field flows directly into four 2,000,000-gal. reinforced concrete reservoirs, passes through the station's aerator and then goes by gravity to the three service pumps. The four reservoirs are circular in design and are covered. The three synchronous-motor-driven pumps at the station are at elevation 200 ft., approximately 16 ft. lower than the reservoirs. All are single-stage, horizontal centrifugal units installed at the time the station was constructed in 1944. Discharging against a total dynamic head of 230 ft., the three pumps are rated at 4 mgd, 6.5 mgd, and 8.6, respectively. They are driven by 200-hp, 300-hp and 400-hp synchronous motors. A 6 cylinder, 450-hp gasoline engine is installed as a standby unit for the 6.5 mgd pump.

The Day Street pumping station currently handles about two-thirds of Montgomery's total water supply, the remaining third coming from the Court Street station which serves the North Montgomery well field. Surveys have indicated that the water table in the north field has been falling steadily over the past 30 to 40 years. It is now at 135 ft. and no expansion of supply is possible. The water is softer than in the west field, averaging about 17 ppm. hardness, and has less chlorine demand.

Chairman of the Water Works and Sanitary Sewer Board is B. Coleman Beace. Vice chairman is Carl W. Bear and third member is Charles M. Covey. The chairmanship rotates on a two-year basis. C. T. Perry is General Manager of the Board, R. W. Storey is Assistant

Manager In Charge Of Distribution And Maintenance and G. W. Cowham is Assistant Manager In Charge Of Supply. Chief Operator at the Day Street pumping station is W. P. Folsom and Chief Operator at the Court Street station is C. E. Royal.

• • •

More Light—Less Cost

(*Continued from page* 96)

A two-man crew handles both the fixture cleaning and lamp replacement jobs. After one man has removed the refractor and unscrewed the lamp, he hands them down to his partner, who supplies a new lamp and clean refractor. While these parts are being installed, the partner is washing the dirty refractor so that it can be used as a replacement on the next fixture. Two buckets are used for this job. One contains a detergent-water mix, the other is filled with clean rinse water.

The old lantern type luminaires, which provide what City Electrician Johns calls "an uncertain one-half footcandle of illumination," are still the main source of light in Elmhurst residential areas, although they are being retired gradually. Cleaning them, compared to cleaning mercury-vapor units, is quite a chore. Eight panels of glass have to be removed. Much of the time required for this operation is devoted to disconnecting the 16 clips that hold the panels in place. After removal, the panels have to be taken back to the electric shop, where they are washed and dried. The washing takes place in a 2 x 4 ft. metal tub filled with the same detergent mix used on the mercury-vapor refractors. Panes are then placed in a nearby powerhouse and left there overnight (the heat inside the powerhouse speeds drying).

Specially equipped trucks have appreciably reduced both the time and expense of servicing the incandescent and mercury-vapor lights. For the incandescents, which are mounted generally on 13-ft. concrete standards, a 1½-ton Chevrolet truck, fitted with a platform that can be raised and lowered, is used. This truck also has a cabinet for holding spare parts and tools, a winch and an A-frame for installing poles. For the mercury-vapor luminaires, a second Chevrolet truck, ¾-ton capacity, with a ladder on the back, is used. This ladder, manually raised, can reach a height of 35 feet above the ground.

Use This Actual Job Story for an Excavating Equipment Check List!

This one water line job demonstrates a combination of features that *only* the Sherman Power Digger offers every operator of excavating and trenching equipment.

Check this performance: (1) The machine has under-dug the curb without damage to the curb or sidewalk. (2) It has trenched through rocks and roots. (3) It is digging a bellhole in the street. (4) The excavation is 9 feet deep. (5) The tractor-mounted digger has operated over the curb, sidewalk and street without damage to paving.

And the Sherman Power Digger offers even more advantages to the operator who wants the savings of mechanized excavating. It's practical even on the smallest jobs, since it releases heavier equipment for bigger jobs . . . yet it digs at a fraction of the time and cost of manual labor.

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The HIGHWAY AND AIRPORT *Digest*

Legal Side of The Highway Job

The highway laws of the various states are sadly outdated. Unless we have the right kind of law, the engineers, contractors and administrators may be unable to use their abilities to provide the best highways most economically. Because departments can not legally prevent commercial encroachment and cross traffic, some roads are being abandoned even though they are structurally good for additional years. In many cases, highway officials cannot buy or option right-of-way which they know will be needed in a few years, until it has been developed and its cost greatly increased. Some laws are so ambiguous that highway officials do not know what they can and cannot do. The Highway Research Board is compiling and analyzing the basic highway laws of all 48 states. Based on its recommendations, North Dakota has completely modernized its highway laws.

"Legal Side of Highway Job Now Commanding Attention." By Louis R. Morony, Director, Laws Div., Automotive Safety Foundation. *Better Roads,* August.

Use of 50-Ton Pneumatic Rollers

Previous to 1954, several experiences on its highways convinced the Texas Highway Dept. that more compaction on subgrades and bases to be subjected to heavy loads would be beneficial. In 1954, after checking with local contractors who had used 50-ton pneumatic rollers on airfield construction, it was decided to specify use of such rollers on subgrade and base construction, and three contracts for such work were let. To date, results obtained on the projects are favorable. On a flexible base it was found that 8 to 10 passes with the heavy roller gave 100% density or better. A similar compaction required 16 to 20 passes with the light rollers. Subgrades not properly compacted or too wet, and base courses placed on such subgrades, will not support the heavy roller. It was found that there was little difference in cost of compacting to a specified density between the heavy and the 20-ton pneumatic rollers. The heavy equipment cost about three times as much as light equipment. The 50-ton roller on earthwork construction requires a crawler type tractor of Caterpillar D7 or D8 size. It is difficult to maneuver in narrow places and on steep slopes. On base courses where surfacing is to be placed and finished smooth, track-laying tractors cannot be used, and the department's latest specifications require a pneumatic-tire tractor to pull the roller for such work.

"Texas Experience With Heavy Pneumatic Rollers." By W. R. Faust, Eng'r, Texas Highway Dep't. *Roads and Streets,* August.

Tar-Rubber Paving For Jet Plane Runways

In constructing the Homestead Air Force Base in Florida, which will have some of the longest runways in the world to accommodate jet planes, more than 365,000 tons of asphaltic concrete and tar rubber will be used. Tar rubber 1½ in. deep will be used for surfacing the aprons and 1,000 feet of each end of the runways to give a surface that is not affected by jet fuel spillage. The rest of the paving material will be asphaltic concrete.

"Tar-Rubber Paving for Jet Plane Runways." *The Constructor,* August.

Thin Concrete Pavement in India

In 1926-28 a highway department in India laid over a mile of concrete slab on top of old macadam on a main highway, using a 1:2:4 mix and a 9-6-9 thickness over a ½ in. layer of sand. Slaked lime, 1½ lb. per bag, was used; and silicate of soda was applied in three coats at 24-hr. intervals. This road still is in first-class condition. Following this, thinner slabs were laid, some only 2 in. thick. For these, the sand cushion was omitted, and they were laid only where the macadam was at least 6 in. thick. At present, because of heavier traffic, slab thickness is made 4 in., and the concrete is laid on a 3-in. layer of stone or overburned brick ballast. Results are considered "satisfactory."

"Performance of Thin Bonded Concrete Slabs on Indian Highways." By M. S. Bisht, Ch'f Eng'r, P.W.D. *Highways and Bridges* (England), Aug. 10.

Machine Computations In Highway Offices

The California Division of Highways has found that the use of computing machines has greatly reduced the time formerly devoted to computing traverses by skilled engineers who might better be employed on more productive tasks. For 19 years it has used electronic machines for the tabulation and solution of many problems, including analysis of origin and destination surveys, of construction and maintenance costs, traffic accident reports, and others. Early in 1955 they began use of a procedure developed by the International Business Machines Corp. for obtaining the sine and cosine of a bearing accurate to seven decimal places. The problem types now being processed are those common to many types of engineering surveys and include traverse computations where all sides and bearings are known; where lengths of two sides are unknown; the length of one side and bearings of another are unknown; and for obtaining the area within a closed traverse. In addition to the electronic calculator, they use key punches, verifiers, collators, sorters, tabulators and reproducing punches. They can obtain both the latitude and departure in one pass of the cards through the machine at a speed of 100 cards per minute. The

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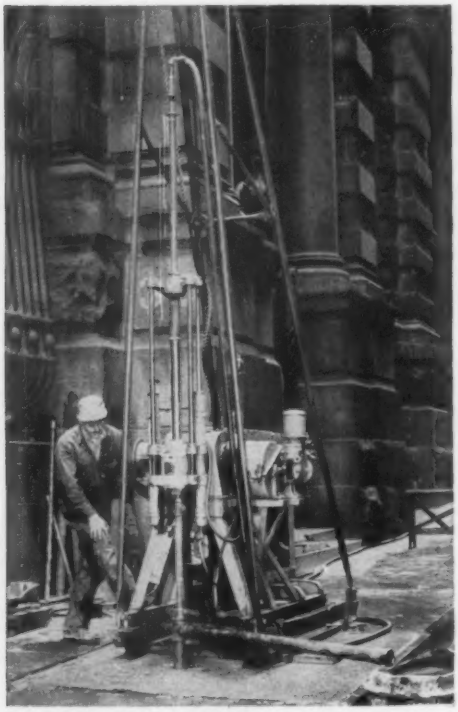

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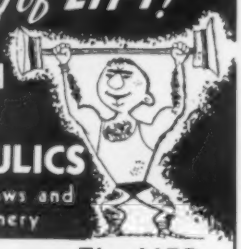

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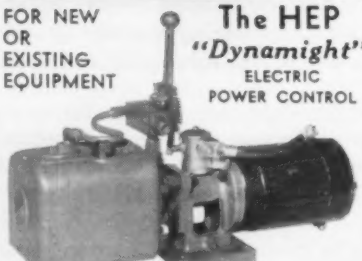

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procedures are described in detail in the article. Where the cost of traverse calculating manually is 13 cents a course, exclusive of checking, the cost of computing by equipment is only 5 cents, including a pro rata charge for machine time. The authors are now turning their attention to the problem of earthwork calculations, traverse adjustments, and other problems.

"Automation: Machine Computations Save Engineering Time." By Sam Osofsky, Statistician, and R. K. Breece, Eng. *California Highways*, August.

Reducing Street Congestion

Corrections that can stimulate flow of traffic in streets include painting lane and center lines; use of uniform traffic control signs; prevention of parking; developing one-way streets; installing modern traffic control equipment; restricting loading and unloading; development and control of off-street parking; channelization by guiding islands. All cities should develop a master plan based on transportation, commercial, industrial and residential needs; a balance between controlled access, arterial and circumferential streets; protection to residential areas; providing setback lines to permit future widening; development of off-street parking; escape routes for Civil Defense; protect unpurchased right-of-way.

"Cities Can Reduce Congestion." By Marble J. Hensley, Traffic Eng., Chattanooga, Tenn. PUBLIC WORKS, October.

Stage Construction Of County Roads

The people of Licking County, Ohio would rather have 15 miles of road improved in gradual stages than one or two miles of high-type pavement a year. In such stage construction, the first step is cleaning and relocating ditches to provide a minimum metal width of 16 ft., and widening bridges and culverts. Then aggregate is added where needed, to which salt water is applied. After at least one winter, the road is scarified to a depth of at least 6 in. and worked over with a pulvimixer. Then brine is added to provide optimum moisture content —about 7500 gal. per mile of road, and the road is mixed again and rolled. After at least one winter, a double-seal surface treatment is placed. Two or three years later about one inch of heavier treat-

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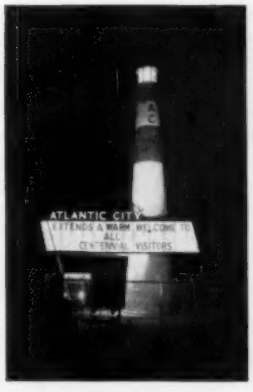

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ment is applied. About 8 or 10 years after the initial surfacing, the road receives about 1¼ in. of hot-mixed asphaltic concrete. The total cost is about $12,700 per mile.

"Stage Construction of County Roads." By James T. Holden, County Eng. PUBLIC WORKS, October.

Vertical Sand Drains For Stabilizing Soft Ground

Since this principle was introduced in California in 1934, it has become one of the leading methods for stabilizing soft marshy ground. The author describes a number of instances of its use. It has proved particularly suitable for depths of 10 to 100 feet, and is 20% to 80% cheaper than other methods.

Vertical Sand Drains." *Roads and Streets*, November.

Snow and Ice Control in Hartford, Conn.

Hartford starts preparation for snow and ice control in late summer or early fall. This includes a re-study of the salting and sanding routes, the plowing routes and the loading routes. Snow equipment is gone over; and arrangements made for hiring private trucks. Sand boxes are placed at about 600 street corners and other strategic points. Catch basins are located so they can be found after snow storms. Arrangements are made for receiving reports daily or oftener from the local weather bureau, the Travelers Insurance Co., the Northeast Weather Service, the New Haven weather stations and the Connecticut State Highway Dept.

Records for the past 50 years show that, while there has been a steady decline in snow fall during the past four years, that for the latest ten-year period was greater than for any previous ten-year period. There is no indication of a permanent change in either snow fall or mean annual temperature.

Winter operations include spreading salt when the snow has reached a depth of one inch. This costs about $37 per mile of street per storm. When 4 to 5 in. of snow has fallen, all street parking is banned throughout the city. Refuse collection is continued as long as possible and refuse collection trucks are not used for snow work. Snow is removed from about 60 miles of streets—about 90,000 cu. yd. during an average winter. One snow loader has filled 39 12-yd. trucks in 50 minutes. The total cost of salt-

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ing and sanding, plowing, and loading averages $5,000 to $6,000 per inch of snow fall per storm. Every cu. yd. of snow that can be melted by use of salt saves 80% of the cost of plowing and carting.

"Snow Removal and Ice Control Operations in Hartford." By Charles W. Cooke, Dir. of Public Works. PUBLIC WORKS, October.

Silicone Treatment Of Concrete Bridge Pavements

The most extensive silicone treatment of highway pavements and structures to date is that made on the New York State Thruway. All Thruway bridges have either a blend of natural and portland cements in their pavements, or Type 2A or 1A cement—the latter in recent designs. Six deck surfaces had shown marked indications of scaling. Bridge pavements appear to be more vulnerable to scaling than highways because of thinner cross-section, vibration, retention of salt brine by flanking curbs, and possibly insufficient air entrainment. Following a preliminary testing of silicone begun in 1952, this chemical has been applied to deck pavements on all Thruway bridges. It prevents water from soaking into the concrete, but does not make the surface any more slippery.

"Thruway Bridges Get Silicone Treatment." *Roads and Streets*, September.

Emulsified Asphalt In Road Maintenance

San Joaquin County, Calif., uses dilute emulsified asphalt SS-1 for many purposes in maintaining its gravel roads. These include dust palliative; for prime coats and seal coats; and as slurry seal. For dust laying, the asphalt is diluted with 8 parts of water and spread with a water wagon. It does not pick up, and one application holds the dust for six weeks. For seal coats, it is diluted about 1:3. For slurry seal, emulsion, water and sand are mixed to produce a very sloppy solution and squeegeed onto the pavement. "Emulsified Asphalt Solves County Road Maintenance Problems." By L. H. Bradley, County Road Com'r. *Roads and Streets*, September.

Maintaining Secondary Streets

In Kent, Ohio, most of the cost of maintenance is spent on cinder, gravel, slag and stone roads. In oiling and sealing these, the surface is broken up with a Galion motor grader that has a scarifier attached;

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then is bladed and shaped and rolled with an 8-ton Galion roller. A prime coat of medium curing asphalt MC-O is spread at the rate of 0.35 gal. per sq. yd. Then a 0.40 gal. seal coat of MC-5 is spread, and on this a layer of #6 slag chips is spread at 40 lb. per sq. yd. and rolled thoroughly. (Crushed gravel is preferred to slag, but is not always available). Trucks are not expected to use these streets, but on secondary residence streets this method has proved very satisfactory. It costs about $1.00 per lineal foot of 24-ft. pavement, $0.61 of which is for materials.

"An Economical Street Maintenance Program." By Frank E. Force, City Engr. PUBLIC WORKS, October.

Bridges on Arkansas Highways

The Bridge Design Division of the Arkansas State Highway Commission usually constructs reinforced concrete slabs on spans up to 30 ft.; structural steel I-beams on spans of 30 to 75 ft.; and for longer spans, plate girders are usually used. Short spans are supported on structural steel or concrete piles where practicable, otherwise on two-column bents with spread footings. Larger bridges are almost always supported on reinforced concrete piers. Primary route bridges are built to heavier specifications than secondary, and still heavier on the interstate system. Roadways are made 24 ft. wide on secondary routes and 26 ft. on primary, and 28 on heavily traveled roads. There has been an increase in the number of existing bridges that are to be widened or otherwise altered.

"Bridging Our Highway System." By L. P. Carlson, Bridge Engr. PUBLIC WORKS, October.

Other Articles

"Prestressed Concrete Structures With Concentrated Tendons." German practice. By Dr. Ing. Fritz Leonhardt. Roads and Road Construction, August.

"Minnesota Cities Like **Road-Mix Surfacing."** A survey of 16 cities. American City, September.

"Precast Curbs." Experience of California highways with a type which is used by the State of New Jersey. By Blair Geddes, Traffic Eng. California Highways, August.

"Airfield Experience Helps Road Builders" in England. Municipal Engineering (England) Aug. 19 and 26.

An **anti-stripping** agent, "Duomeen T," developed by Armour & Co., "as a meat processing byproduct." Research on Meat Aids Roads and Lighting." By Derek Phillips. Municipal Engineering (England), Aug. 19.

"Soil-Cement Stabilization in Pampa," Texas. By James H. Cowan, Dir. of Public Works. Public Works, October.

"Horizontal Drilling: New California Approach in Landslide Control." By A. W. Root, Eng'r, Calif. Div. of Highways. Roads and Streets, September.

"How Clinton County (N. Y.) Charts Its **Snow Plowing** Equipment Hours." By John H. Coffey, Sup't of Highways. Roads and Streets, September.

"Where Do We Go in **Bituminous Design**?" By H. G. Nevitt. Roads and Streets, September.

"Maintenance of Street Surfaces." By Jack D. Markham, Dir. of Pub. Wks. Public Works, October.

"Solving **Shoulder Maintenance** Problems" by use of calcium chloride. By W. E. Dickinson, Calcium Chloride Inst. Public Works, October.

"Urban Links for **U. S. Road** Plan" complete overall designation of interstate highway system by Bureau of Public Roads. Engineering News-Record, October 6.

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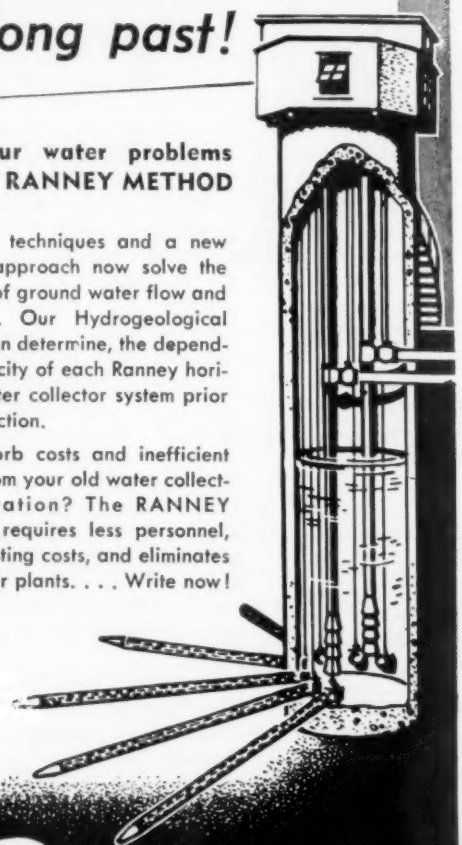

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PUBLIC WORKS DIGESTS

The WATER WORKS *Digest*

Turbidity and Color Definitions

An English author describes a photometric method of determining the color and turbidity of water, and proposes new standard definitions of turbidity and color which would enable their determination in a sample by measuring optical densities with two different light filters. The author gives a nomograph for correcting the color reading for the effect of any turbidity present, and the turbidity of reading for the effect of color.

"Photometric Determination of the Color and Turbidity of Water." By A. T. Palin. *Water and Water Engineering* (England), August.

Greeley's Unusual Water Supply

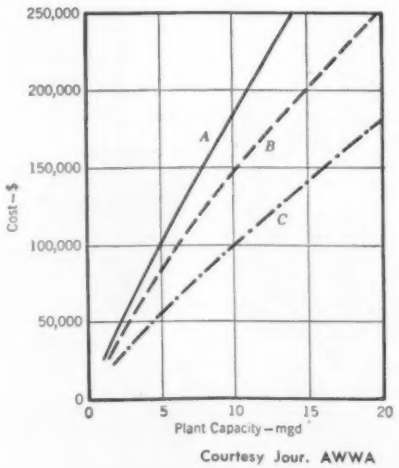
Greeley, Colo. obtains its supply from lakes, diversion ditches, direct diversion rights from a river, and a contract with a water conservation district. The lakes are scattered over a wide area high up in the Rocky Mountains 75 to 100 miles from Greeley. The diversion ditches transfer water from one watershed to another. The lakes furnish a storage capacity of about 9,250 acre-feet. A man is employed the year around to keep a close watch on the flow into and out of the lakes and ditches and operate flood gates to prevent overflows. Prior to the spring thaw each year, it is necessary to clear the ditches of the snow accumulated there during the previous winter.

"Little City, Big Water System and Lots of Snow." By B. H. Cruce, City Manager. PUBLIC WORKS, October.

Current Trends In Plant Design

The present trend in water treatment plant design seems generally to stress better and more efficient methods of pretreatment, thus reducing the burden on the filters. But there is no need of pretreating water to bring it to almost at the desired clarity before filtration and thus increasing the cost of plant construction and operation. Presedimentation basins are seldom necessary. In mixing, uniform velocities should be maintained and the use of the baffle type of coagulation basin has been almost abandoned. Mixing equipment should allow the attainment of any desired velocity; the best velocity must be ascertained from actual plant operation. For sedimentation, a circular or square basin is the most advantageous shape. The present tendency is to increase the detention time to 3-5 hr. The necessity for sludge removal equipment is debatable, except in softening plants. From an economic standpoint, mechanical sludge removal equipment cannot usually be justified unless a high value be placed on the desire to eliminate a periodic and messy cleanup.

The hydraulic design of filter bottoms has been greatly improved. Sand cleaning is now generally being accomplished at more moderate upflow rates with scrubbing by surface wash systems. Chemical feeding has become an almost completely dry procedure, except for use of commercial liquid alum by some large plants. Many plants now spend more for chemicals for taste and odor control than for disinfection.



Courtesy Jour. AWWA

● **COSTS of clarifiers. A-Upflow, 2-hr. dentention; B-Conventional, 4-hr. settling; C-Upflow, 1-hr. detention.**

"Current Trends in Treatment Plant Design." By Louis R. Howson and William W. Aultman. *Journal AWW Ass'n.*, August.

Suspended Solids Contact Clarifiers

Proprietary basins of this type are now used in hundreds of plants. Appleton, Wis. has had two in operation for more than seven years, and also a conventional clarifier. Neenah, about 7 miles away, takes its supply from the same river and uses the same method of treatment as Appleton, but in a conventional plant. Comparing the two-types of plant, the author finds that use of the suspended solids contact basin permits an appreciable saving in lime—estimated at 22 percent in 1953. But the carryover of solids is excessive at rates beyond 2 gpm per sq. ft. of contact surface; the effluent at times contains turbidity in the form of disintegrated algae, fine activated carbon and other matters. The conventional system is more satisfactory when the supply has high concentrations of decomposing algae and receives high dosages of carbon. At other times the contact softeners may be used advantageously.

"Current Trends in Treatment Plant Design." By W. U. Gallaher, Plant Sup't. *Journal AWW Ass'n*, August.

Chlorine Dioxide For Algae Control

Studies undertaken at Philadelphia's Torresdale filtration plant show that chlorine dioxide is a more effective algicide than copper sulfate and has the advantage of not introducing a detrimental element such as copper into the finished water. Moreover, tastes and odors from the essential oils associated

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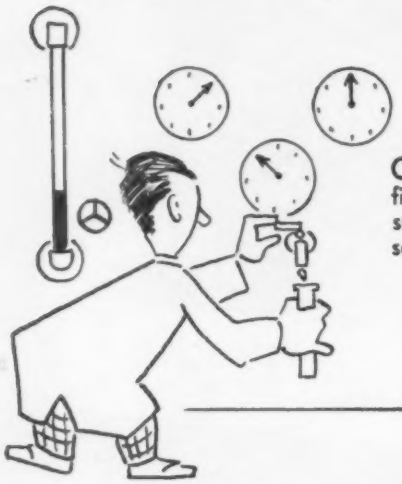

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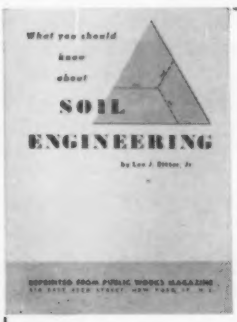

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with algal growths are eliminated. In 1951, when copper sulfate was used in the reservoir in concentrations as high as good practice permitted, the cost for the copper was $7,128; labor for surface applications cost $1,152. In 1954, when the maximum amount of chlorine dioxide was used, the cost was $14,765; but the extra cost may well be considered as offset by the much better quality of the finished water.

"Use of Chlorine Dioxide for Algae Control at Philadelphia." By Walter C. Ringer, Supervisor of Labs, and Sylvester J. Campbell, Chief Chemist. *Journal AWW Ass'n*, August.

Effect of Chlorine On New Mains

Complaints of red water in Bismarck, N. D. led to an investigation which revealed iron content in the water following the laying of new tar-lined iron mains, which had been sterilized by use of 100 ppm residual chlorine held for at least 24 hr. It was found that the tar lining was damaged in as short a time as 45 minutes. Following this, cement-lined pipe was used, the chlorine dose was reduced to 50 ppm and the contact period to one hour; red water complaints ceased.

"Effect of Disinfection Dosages of Chlorine on New Mains." By William Yegen, Supt. *Journal AWW Ass'n*, August.

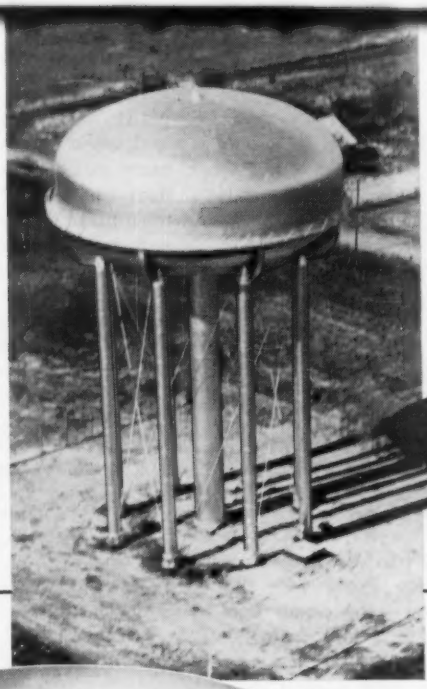
Safety Practices For Water Utilities

A committee of the AWWA has prepared a Manual of Safety Practices for Water Utilities. Part 3—"Safe Working Practices" is published in the August issue of the Journal of the Society. The ten sections under which the matter is classified are: General Safe Practices. Hand Tools. Portable Power Tools. Storerooms and Stockrooms. Vehicle Driving. Working in Manholes. Building Operation and Maintenance. Fire Protection. Trench Construction. Blasting Operations.

"Safe Working Practices." *Journal AWW Ass'n*, August.

Waste Pickling Acid As a Coagulant

Akron, Ohio, used aluminum sulfate as a coagulant in its plant completed in 1915. In 1935 it began the use of ferrous sulfate when it found that pickling liquor could be obtained from a factory 5 miles away. This liquor is chlorinated at the



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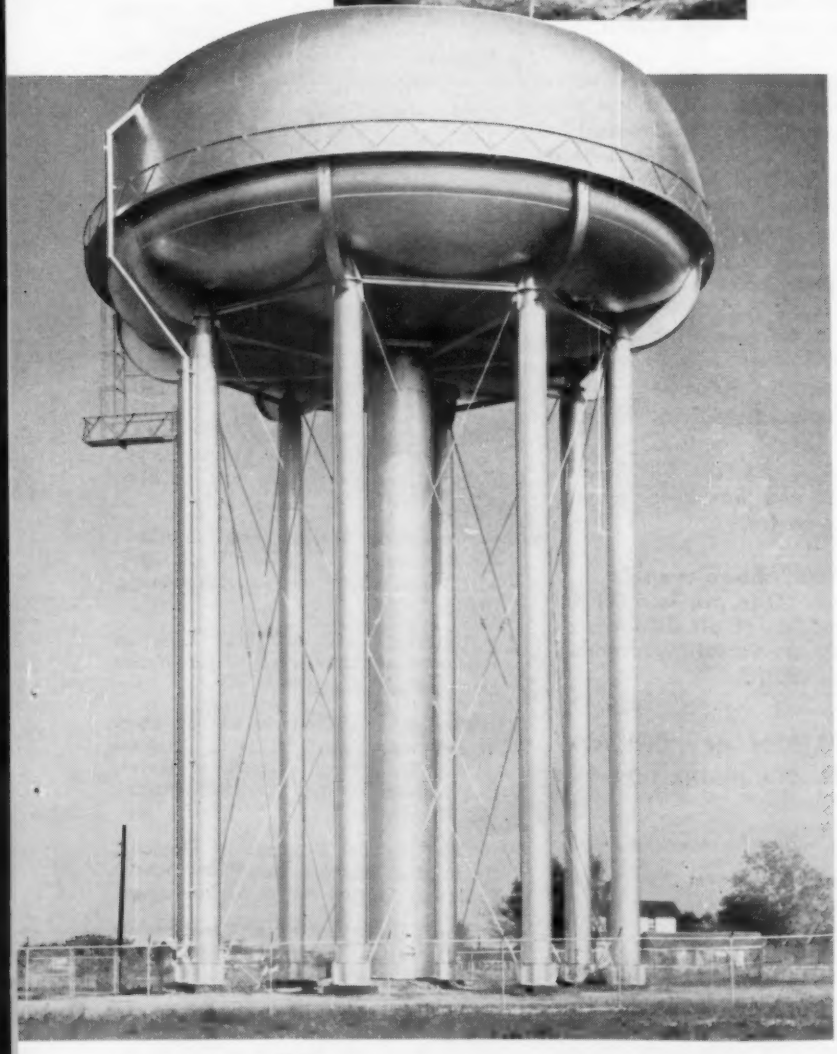

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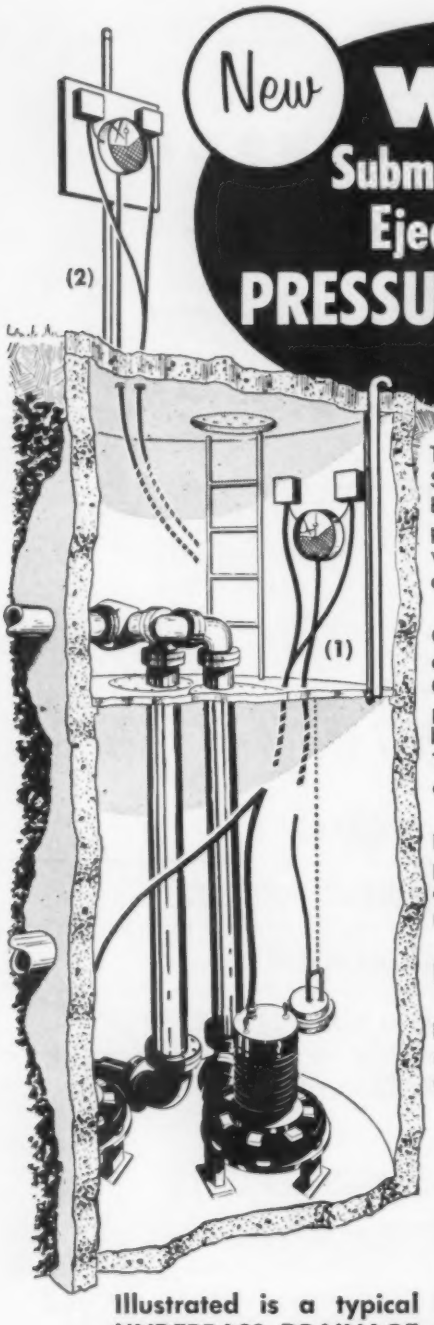

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"Utilization of Waste Pickling Acid in Potable Water Treatment." By J. S. Gettrust, Supt. *Journal AWW Ass'n*, August.

Other Articles

"Big **Steel Trunk Mains**" used by New York City since 1925. By Edward J. Clark, Chf Engr, Bureau of Water Supply. American City, September.

"Filtration Plant Extensions and New Workshops of the **Taf Fechan** (Wales) Water Supply Board." A technical description. Water and Water Engineering (England), August.

"**Small Dam** Proves to Be No Small Job." Santa Felicia dam, to create a 100,000 acre-foot reservoir, is a rolled-earth-and-gravel fill, with oil seepage to contend with. Engineering News-Record, Sept. 8.

"**Pressure Relief** Station for Colorado Aqueduct System." By Robert A. Skinner, Ass't Chf Engr. Water Works Engineering, September.

"Alum and Lime Treatment Cures **Iron and Turbidity** Troubles"; incrustation of pipes of steel company by turbid and polluted water. By W. W. Armstrong and H. E. Case, Dravo Corp. Water Works Engineering, September.

"**Controlled Storage Draft** Planned for Economic Use" of New York City's reservoirs. Water Works Engineering, September.

"Chicago Data on Head Loss in **Backwashing of Filters.**" Water Works Engineering, September.

"Design and Construction of **Steel Wye-Branch** Pipe." By H. J. Chapton and H. S. Swanson, Dep't of Water, Los Angeles. Water Works Engineering, September.

"**Short School** Program in Oregon." By Fred J. Burgess, Dir. Short School Program. Journal AWW Ass'n August.

"Short History of **Filter Construction** and Operation." By G. R. Scott. Journal AWW Ass'n, August.

"**Low-Temperature** Problems in Alaska." By Amos J. Alter. Alaska Dept. of Health. Journal AWW Ass'n, August.

"**Mixing and Sedimentation** Basins; Revision of Water Quality and Treatment." Chapt. 8 of the book by that name published in 1950 by the AWW Ass'n. Journal AWW Ass'n, August.

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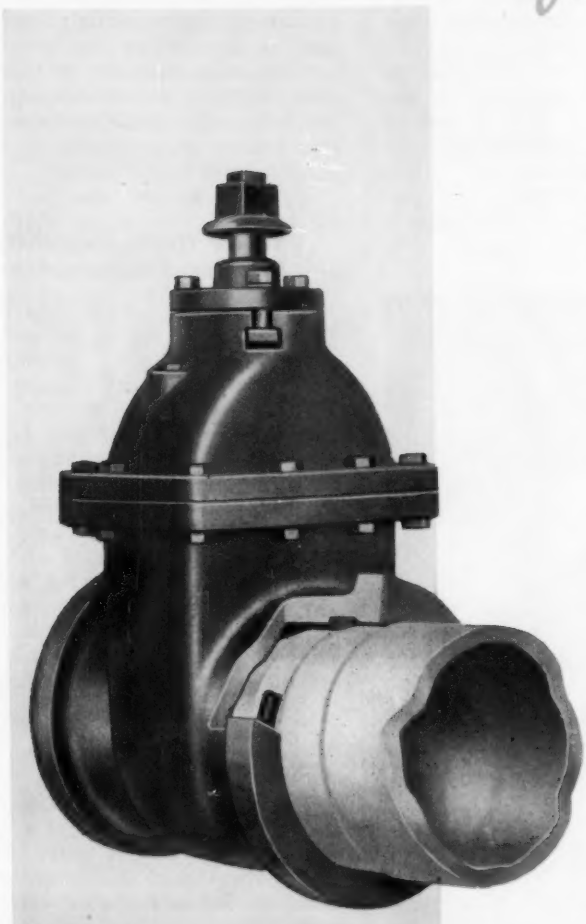
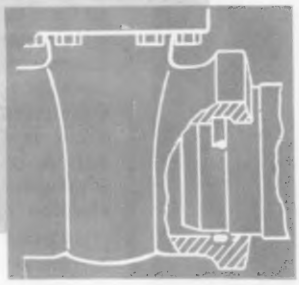


RENSSELAER VALVE WITH "O"-RING SEAL AND RING-TITE JOINT.



Rensselaer Valve Co. in cooperation with Johns-Manville has adapted Gate Valves and Hydrants to the Ring-Tite Joint, developed by Johns-Manville for Transite Pipe. The first experimental installation of Ring-Tite valves was made in July 1953 at Mattapoisett, Massachusetts.

FAST AND SURE INSTALLATION

Rensselaer Ring-Tite Gate Valves and Fire Hydrants permit quick and simple installation with Transite Pipe. No special fittings are required and labor cost is low. Ring-Tite Bells provide tight, flexible joints.

During assembly, rings are inserted in the grooves, pipe ends are lubricated and the pipe is pulled in — sliding under the rings and slipping along until movement is stopped by shoulders on the pipe. A very simple puller is used and the job is accomplished quickly and with very little effort.

At low pressures, the seal is obtained by radial compression of rubber rings. At higher pressures, rings are wedged in the grooves tighter by the pressure.

Rensselaer Gate Valves with Ring-Tite Ends are available in sizes 4″ through 12″ for Transite Pipe.

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Packing Waste Treatment

(*Continued from page* 103)

fic gravity of these particles and raising them to the surface of the flotation tank. This occurs over the entire area of the flotation tank, resulting in non-turbulent uniform flotation. The entire process occurs in a treatment cycle of approximately 12 minutes at the Kahn plant.

Grease and solids floated to the surface are continuously pushed by flight scrapers towards the recovery trough at the far end of the separator. The adjusted scrapers do not dip into the body of the liquid; thus the liquid is not disturbed. Sludge is collected in the recovery chamber from which it is pumped to the inedible rendering department.

Clarified effluent is continuously removed from the bottom of the flotation chamber through uniformly-spaced recovery tubes with adjustable height risers. The effluent, which discharges directly into the city sewers, has a BOD of 800 to 900 ppm., with suspended solids of 500 to 600 ppm. Sludge, which amounts to about 30,000 pounds per day, is watery. This is pumped to a holding tank, dewatered to about one-fifth its raw volume and blended for rendering.

The nature of the job done is attested to by the fact that the Colloidair installation is currently saving the company about $15,000 per year on sewerage charges while, at the same time producing an effluent that is satisfactory to the civic authorities in the area. In addition, about 10,000 lb. of valuable fats, tallow and protein solids are recovered each week.

• • •

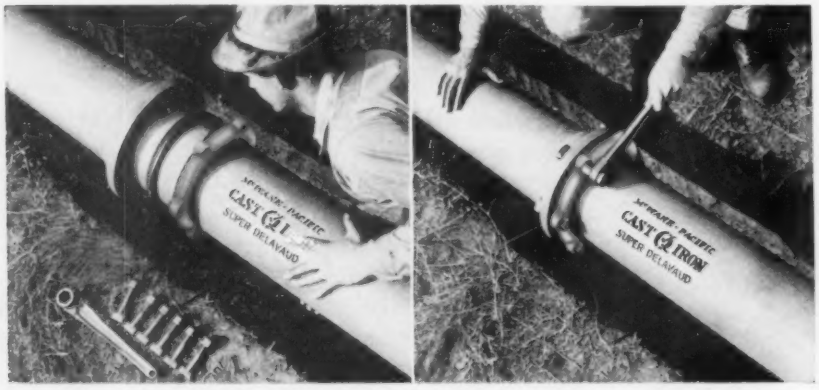
Waste Water Irrigation

(*Continued from page* 98)

pended solids and 2,100 ppm BOD. These industrial wastes without any pre-treatment are periodically spread upon different sections of a 240-acre farm. The effluent infiltrates into the sandy soil leaving the suspended solids on the soil surface. The organic mat is plowed into the soil while the infiltrated water pre-irrigates the land. Crops are then planted and irrigated with well water during the growing season. The orange products wastes are alternately diverted to different sections of the farm. No appreciable organic buildup has resulted under this method of farm operation. The sale of farm crops largely supports the waste treatment and farm operation expenses.

Mineral Quality of Irrigation Water—The mineral quality of a waste water is important. A water with a high percentage of sodium (with respect to the total cation content), may deflocculate the soil colloids and reduce soil permeability. Water with greater than 65 percent is considered poor; 50 to 65 percent is of questionable quality; and water containing less than 50 percent sodium is satisfactory for irrigation. (6) A boron content greater than 1 ppm may be unsatisfactory for irrigation of such sensitive crops as citrus or walnuts. Saline waters and heavy concentrations of certain minerals may damage plant growth and degrade ground water. Highly mineralized wastes where possible should be segregated from waters that are to be reclaimed for irrigation. Analysis of water supplies and sewages from several California communities indicates that there is a normal buildup of 100 to 300 ppm in the dissolved mineral content for domestic sewage. (2)

Nuisance and Health Hazards — Ponding of waste waters from over-irrigation should not be permitted, as anaerobic conditions may result; an aerobic environment minimizes



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the development of odors. The breeding of mosquitoes and flies is prevented by eliminating ponding and the accumulation of organic debris. If required, conventional insect control procedures can be employed.

In California alone there are 69 localities that use waste water for crop irrigation. (6) There have been no cases of disease transmission or of ground water pollution occurring as a result of this practice. A review of the literature indicates that the cattle disease, **cysticerous bovis,** may be transferred to beef cattle grazing in pastures freshly irrigated with raw sewage. (7)

Soil Permeability and Irrigation Rates—Sandy soils should take more waste water than fine clay soils. Irrigation of tight soils results in the water being utilized for plant transpiration and evaporation. Subsurface drainage may be required to leach out the minerals that would otherwise cause an alkali soil. The range of irrigation rates that might be expected for forced irrigation of different soils will vary from 5000 gpad up, depending on many local conditions. (8)

Normal vegetation may require 3 to 5 feet of irrigation water a year. Forced irrigation can maintain considerably higher irrigation rates as a means of effluent disposal. Climatic factors are important in tight soils. Grass, shrubs, and trees assist in maintaining good soil structure and permeability.

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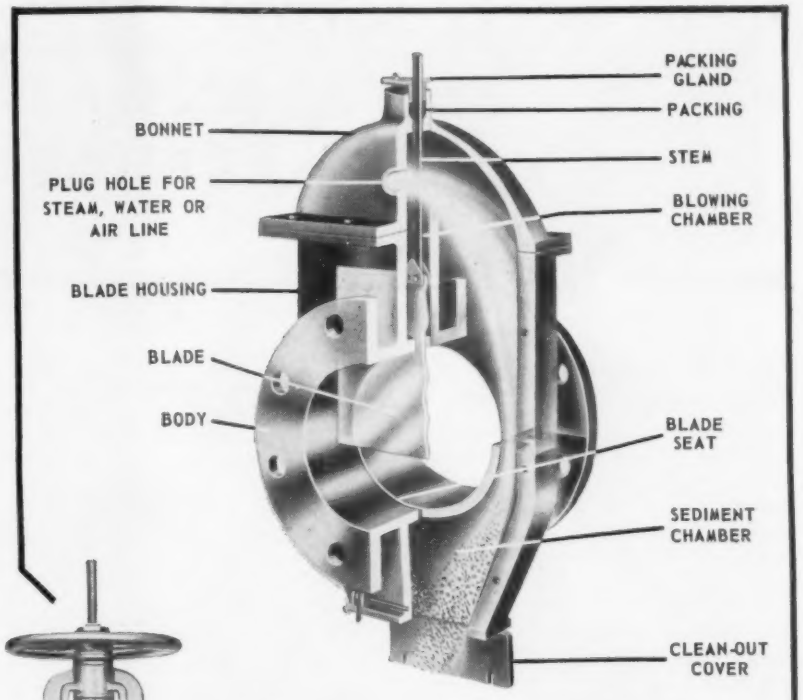

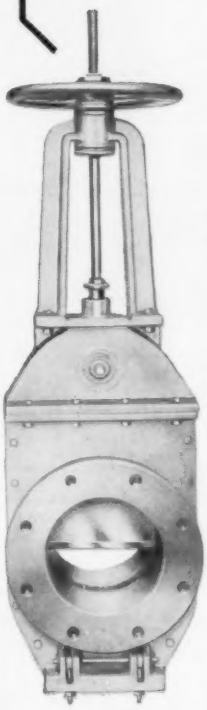

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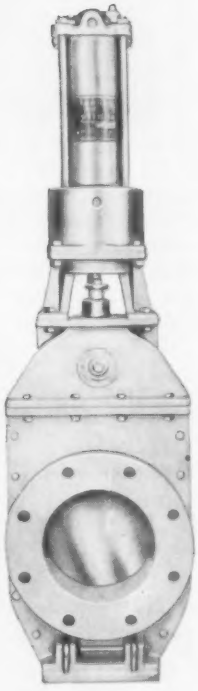

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The SEWERAGE AND REFUSE *Digest*

Pumping Cheaper Than Construction in Tunnel

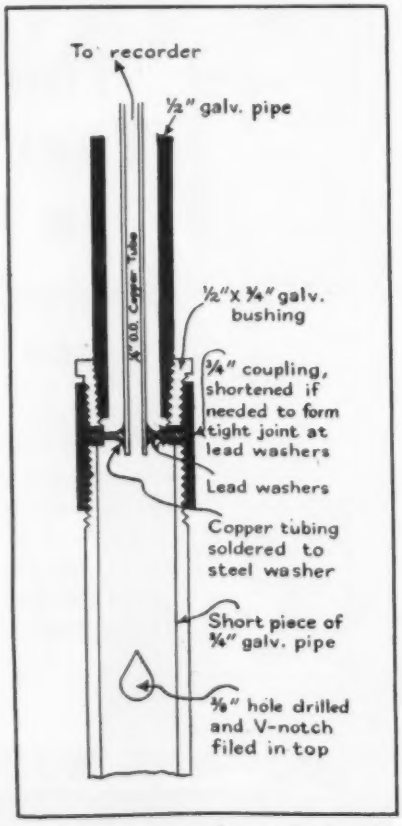
Part of the city of Baltimore has been served by two small sewage treatment plants that are no longer adequate, and it was decided to carry the sewage from this area to the Back River sewage treatment works. This necessitated constructing either a gravity sewer built in tunnel; or a pumping station, force main and tributary sewer. The operating and maintenance costs of the former would be much less than those of the latter, but the construction cost would be so much greater that yearly cost studies showed that the plan involving pumping would be the more economical. The 30-in. force main, of prestressed reinforced concrete cylinder pipe, designed to carry a pressure of 170 lb. per sq. in., is 3,736 ft. long. This is followed by a 36-in. pressure sewer 13,274 ft. long, and this by 2,715 ft. of 27 and 30-in. gravity sewer. The specification for the pressure sewer built of prestressed concrete cylinder pipe provided that leakage should not exceed 15 gal. per day per inch of diameter per mile; the leakage tested at 10.9 gal. The bid for the pumping plant was $504,978; that for the force main was $117,124; for the pressure sewer, $628,680; and for the gravity sewer, $113,502.

"Baltimore Builds $3 Million Jones Falls Pumping Project." By C. E. Keefer, Deputy Sew. Eng. *Wastes Engineering*, September.

A New Type Sewage Gauging Device

Columbus, Ohio, has developed a system of gauging installations by which they measure the flow of sewage at various points and study run-off from precipitation. The device used is portable, can be used in any manhole, requires no outside source of power. The registering portion is housed above ground in a steel case not objectionable to sight, rugged, and accessible in any weather. That in contact with the sewage does not affect the flow; resists attack by sewage, acids and alkalies, and does not permit sewage solids to become entangled in its mechanism. The pipe leading from the sewage to the registering device is purged by bubbling dry compressed air through it continuously. Three months' service is obtained with 105 cu. ft. of compressed air. (See illustration). This gauge has proved economical in both first cost and operation. An aim is to add a device that will give a continuous chemical analysis; this will permit estimating the amount of dilution by storm water, and make automatic sewage treatment feasible.

"A Low-Cost Sewage-Gauging Station — That Works." By U. E. Whiteis, Dept. of Sewage. *American City*, September.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Lead washers
Copper tubing soldered to steel washer
Short piece of ¾" galv. pipe
⅛" hole drilled and V-notch filed in top

Courtesy American City

● **DETAIL of the registering device.**

Lighting Treatment Plants

Lighting sewage treatment plants presents conditions peculiar to such plants. These include the presence of corrosive and explosive gases. The lighting fixtures therefore should be vapor proof and dust tight and easy to service and clean. The lighting circuits should be oversize so larger lamps or additional units can be installed later. Lighting units should be spaced so the light overlaps 0.5 to 1.0 time the mounting height. The author recommends reference to a booklet "Lighting for Industry" published by the Holophane Co., and to the American Standards Association's "American Standard Practice for Industrial Lighting." He describes in detail the lighting of the Hyperion (Los Angeles) plant.

"Lighting for a Sewage Treatment Plant." By H. M. Hays. PUBLIC WORKS, October.

Refuse Collection In Cincinnati, Ohio

In recent years collection methods have been changed to meet the changing character of municipal refuse, which has become bulkier and lighter because of: 1. Increased consumer spending and disposable packaging items like wrapping paper, bags, and cartons. 2. Packaging of merchandise and food-stuffs with more paper and wrappings, and wrapping in smaller units. 3. Long-range trend toward municipal collection of waste paper because fluctuations in market price have discouraged its collection by scavengers and organized charities. 4. Ever-increasing use of automatic home heating plants has eliminated home disposal of most of this easily combustible waste. This change has been met by substituting enclosed packer-type bodies for open trucks. The city now has 102 Load-Packers

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in service, with 12, 15 and 16-yd. bodies. Two crews are assigned to three trucks so that, as soon as one packer is loaded, another is ready to take its place.

"Modern Refuse Demands Modern Collection Methods." By Ralph C. Taylor, Supt., Waste Collection. *American City*, September.

Combined Domestic and Industrial Waste Treatment

The new Sugaw Creek treatment plant of Charlotte, N. C., provides for treatment of the city's domestic sewage and also for the industrial waste produced in the community. A City ordinance stipulates that the portion of the cost of the plant—$500,000 of the $3,500,000 total—be paid for by contributing industries; also a portion of the operating costs are paid by industries, both charges being based on the strength of the wastes in pounds of BOD. The plant is a modern and complete one, utilizing primary settling tanks, roughing filters operating on loadings as high as 9,000 pounds of BOD per acre-foot per day, activated sludge and final settling. The article, which is illustrated with four-color pictures and a flow diagram in four colors, provides an excellent engineering description of the plant.

"How Charlotte Provides Complete Treatment for Combined Sewage and Industrial Wastes." By Walter M. Franklin, Superintendent, Water Department. PUBLIC WORKS, October.

Proportioning Chlorine To Sewage Flow

Laconia, N. H., made a study to determine the general dose level at which an adopted chlorination schedule should be maintained to produce an effluent of acceptable bacterial quality. Raw sewage to the pump well is chlorinated as well as settling tank effluent. As a result, it was recommended that the daily minimum chlorine dose should never be allowed to drop below 14 ppm; which can be achieved by selecting a night-and-day dosing schedule; and that the combined chlorine residual of settling tank effluent never be allowed to drop below 1.0 ppm. It is believed that this procedure would save perhaps 50% of chlorine, or about $1500 to $1800 a year. It is proposed to install chlorine dose-proportioning equipment, which should not cost over $1500.

"Bacterial Reductions in the Chlorination of Sewage." PUBLIC WORKS, October.

Two-Stage Filters For Dallas, Texas

Dallas in 1940 constructed a treatment plant that included 16 standard-rate trickling filters. These, when loaded up 1,000 lb. per acre-foot, produced an effluent averaging 27 ppm of BOD, or 91.5% overall removal. In 1954 it put in operation a new plant containing eight filters similar to the original ones except that larger rock sizes were used, 3½ to 4½ in. Experiments with single-stage standard rate filters have suggested operating the enlarged plant as two-stage high-rate primary and low-rate secondary filters, without intermediate settling. They estimate that this will permit reducing by six the total number of filters originally planned for expansion. Four-color pictures accompany the article.

"Trickling Filters Are the Answer to Dallas' Sewage Treatment Problems." By Cecil H. Williams, Supervisor, and Henry Graeser, Supt. PUBLIC WORKS, October.

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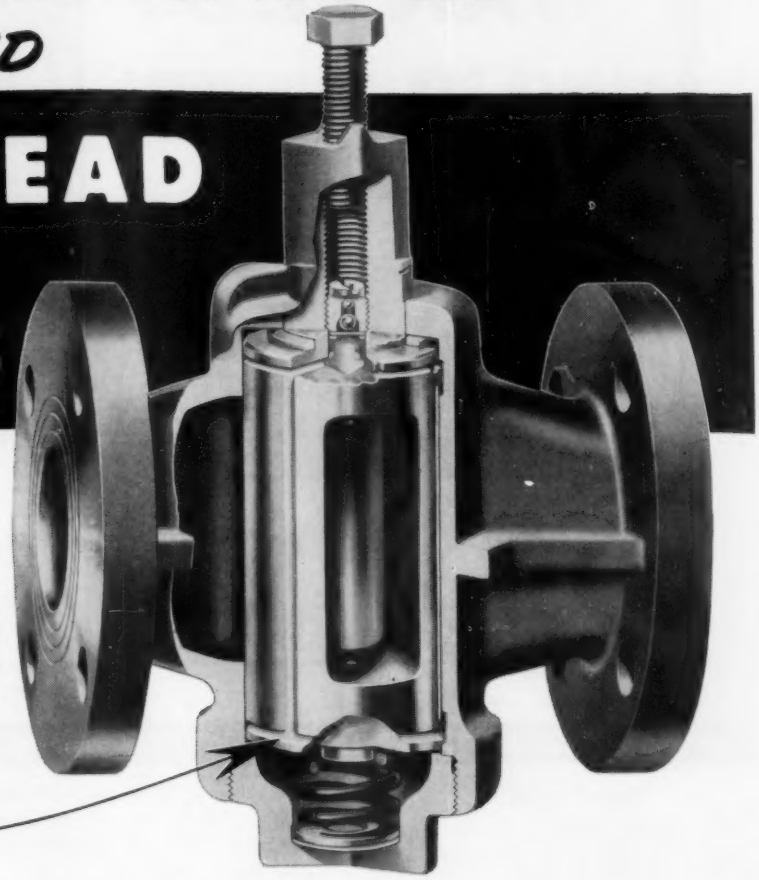

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"The **Dano System** of Edinburgh," recently installed, with a capacity of 20 tons of refuse a day, is the first fully mechanized plant in Great Britain. Contractors Record, Aug. 3.

"Modern Developments in **Controlled Tipping.**" Effect on ground water; California, English and German investigations. By Horace E. Gilby, Eng'r, Hertford (England). Jour., Royal Soc. of Health (England), August.

"Ore Port **(Ashtabula, Ohio)** Builds a Disposal Plant." Public Works, October.

"Getting the Best Performance from Your Sewage Works: Safety in the Operation of **Booster Pumping** Stations." By Le Roy W. Van Kleeck. Wastes Engineering, September.

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Airphoto Interpretation

(*Continued from page* 104)

drained sand and others of shallow soil over bedrock.

A recognition of landform alone will not answer such questions. Yet a good interpreter can answer these and similar practical inquiries because he goes beyond the landform. He recognizes the logical fact that soils and rocks of different characteristics respond differently to the forces of weathering and that these different responses are reflected by details of drainage, tone erosion and micro-features. He, therefore, analyzes these features.

Surface Drainage Pattern — The characteristics of the materials in an area determine the density, arrangement and other features of the integrated overall pattern. Conversely, the characteristics of the pattern indicate the type of material, as well as its boundaries. For example, a lack of integrated drainage may indicate that the material is pervious. A closely spaced, well integrated pattern may indicate uniform, impervious material.

Gray-Tones — A "black-and-white" photograph is composed of numerous gray-tones. These tones represent the film's registration of actual soil and rock colors; the reflective characteristics of various vegetative covers; and the degree of moisture present in the soil. The latter indication is of particular value. All other things being equal, it can be expected that dark tones will indicate large moisture contents and light tones, low moisture contents. The deductive implications of gray-tones as indicators of soil moisture—and soil texture—are extremely important.

Erosion features, namely gullies, are usually of minor extent. Occasionally, they may occur on a large scale. Whenever visible, they are valuable indicators of soil texture. Since gullies cut through the soil, their cross-section, length and gradient are controlled by the physical properties of the soil. Typical gullies in gravel are short, steep, V-shaped "nicks." Gullies in clays are long, gently sloping swales.

Other Features—Numerous other details are important, sometimes dominantly so. These include details of vegetation, culture, boundary conditions and micro-features of either local or regional significance. Knowledge to interpret these important details is gained only through experience.

Pedology—It is important to emphasize that a knowledge of pedology, the science concerned with the formation of soils in place, is of inestimable value to the interpreter. By applying the principles of pedology to the soil patterns appearing on an airphoto, it is possible to make startlingly accurate predictions regarding the soil characteristics. These predictions can be extended to the degree of predicting the general number, texture and depths of generic soil layers and providing a rough estimate of their physical classificatory constants,

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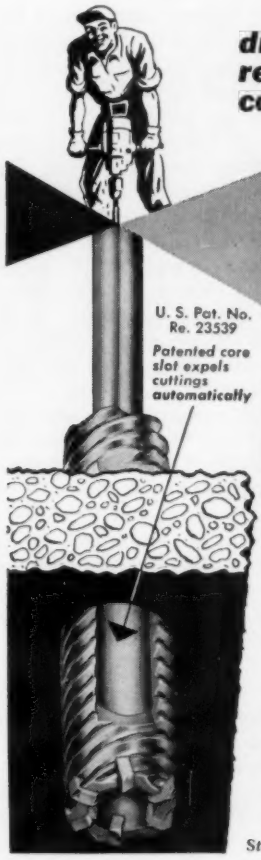

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such as plastic index, liquid limit, etc.

The final interpretation is completed by weighing the individual indication of each element—drainage, landform, tone, etc., and forming a conclusion on the basis of coincidence of indication. It is important to realize that at any point within this process, the interpreter may find it desirable or necessary to insert a photo-planned field reconnaissance or sampling trip for purposes of securing more reliable information or expanding the results of interpretation more broadly. However, in general, the process of interpretation follows the Webster's definitions of deduction and induction, e. g., "reasoning from the general to the particular, or specifically from given premises to their necessary conclusion," and "reasoning from particulars to generals."

The interpreter may examine large-scale figures such as the area drainage network. By deducing the causative factors that would logically and physically produce such a pattern, he infers specific characteristics of the materials within the area covered by the network. Following this evaluation, he may examine the specific characteristics of an individual gully within the network, and by exercise of logic and experience infer additional or corroborative characteristics that can be expanded over the entire area typified by similar gullies.

Soil Materials Location

The location of soil materials provides an excellent field for the application of aerial photographic interpretation. When engineers speak of "construction materials," they refer, generally, to natural materials that can be used in construction with only slight modification or treatment—boulders, gravel, sand, clay and rock.

To use these materials, the engineer must first locate them, and secondly, determine their suitability for the desired construction. The determination of suitability—soundness, action in concrete, composition, shape, etc.—must be accomplished by means of adequate field and laboratory tests. Airphoto interpretation can often be of value in comparing the probable quality of two material deposits, and thus provide a key to their field investigation. However, it obviously cannot, by itself, provide any conclusive factual data concerning quality and characteristics of the material deposit in question. These must be investigated in the field and laboratory.

Photographic interpretation can be used successfully to locate sources of materials having the characteristic grain-sizes and permeability normally associated with the materials desired. It can be used to locate favorable rock-types for commercial exploitation. It can be used to locate boulder fields. In many cases, airphoto interpretation has located undetected and unsuspected sand, gravel and clay deposits in relatively small areas that had been surveyed and resurveyed. The author remembers one case, in New Jersey, where a gravel deposit was being sought in an area some three miles square. A glacial esker, located in the area, had been cut through, many years before, by a county road. During the intervening years, the cut banks had been overgrown with shrubs, and since it was a small and narrow deposit, partially buried, its typical elevated, sinuous landform was undetected by field survey crews. One stereoscopic look at the airphoto—not even involving any interpretation—was sufficient to reveal its existence

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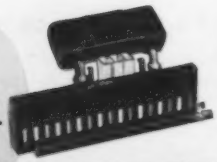

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In this case interpretation was hardly necessary. Landform identification sufficed. There are many cases in which further interpretation is necessary, in accordance with the principles previously outlined. These instances provide the best examples of the value of interpretation and demonstrate its superiority over other methods.

Of course, landform always provides a valuable guide. Most deposits of soil materials are associated with water sorting. Consequently, landforms characteristic of water sorting are sought eagerly by the interpreter. The simple landforms, such as the esker in the example given above are quickly identified and easily evaluated. The complex landforms—outwash, till, glacio-lacustrine deposits, complex interminglings, glacial deltas, alluvial deposits, etc.—are more difficult.

Route Location

The location of transportation routes is more complex than materials location in many ways. The complexity is due to the factors involved. An adequate and intelligent route location should be determined in accordance with factual knowledge concerning the following items: 1) Alinement possibilities; 2) grade possibilities; and 3) construction condition possibilities, including (a) bedrock occurrence —surface and subsurface; (b) soil conditions—texture, profile contrast and porosity; c) drainage conditions —depth to water table, local impeded drainage, surface drainage requirements; and d) special considerations—roadside erosion, landslide and corrosive potential, etc.

A route location made without adequate knowledge of these items may be given the name by courtesy only. Yet, because of the expense and time involved for field surveys by conventional methods, too many routes are located according to line and grade, the design being based upon the assumption of an average ideal subgrade, modified by consideration of whatever scanty soil and drainage information may be available. The project engineer is sent forth to do battle with nature armed only with his experience and philosophy, while the maintenance engineer places a new peg in his status board. A few years ago, such a compromise with reality was excusable on the basis of time and money economy. It is no longer so. Aerial photographic interpretation can provide usable information on most of the factors, itemized in the previous list. If it cannot provide the information by itself, it can be used to preplan the field survey so that it will be most efficient and rewarding. This aspect of interpretation is often forgotten. The plan is based on the reasonable assumption that two areas having similar photo patterns will have similar near-surface characteristics, similar engineering properties and similar engineering problems. If a route passes over substantial areas of similar photo-pattern, it is not necessary to sample every 100 or 300 yards. It is necessary to sample only occasionally—to verify uniformity. In this manner, that 90 percent of the area giving 10 percent of the trouble can be subjected to 10 percent of the sampling effort, while the remaining 10 percent of the area giving 90 percent of the trouble can be sampled intensively in advance—or possibly avoided.

In these examples, basic information on route characteristics is known before the location crews are sent in the field. When they are in the field, they can plan alignment, grade and sampling in full possession of knowledge regarding important construction conditions and their probable effects.

Questions concerning availability of photography, as well as time and cost of interpretation may be raised. Aerial photography of suitable scale, although not quickly obtainable, is available for approximately 90 percent of the United States and for a surprising number of foreign areas. The cost and time of interpretation is variable, depending upon the ability and experience of the interpreter, complexity of the terrain, quality and scale of the photographs and the information desired. However, in general, the interpretation may be said to involve hundreds rather than thousands of dollars and days or weeks instead of months.

In the author's opinion, any conscientiously executed route location must compare the costs of aerial photographic interpretation with the advance information that can be derived from it. If this comparison is made, few route locations of any substantial length or cost will be made without it.

A description of the method of preparing a map is described in "Preparation of an Engineering Soil Map of New Jersey," D. R. Lueder, Symposium on Surface and Subsurface Reconnaissance, "Proceedings American Society for Testing Materials," 1951.

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Sea Water Intrusion Studied

ALREADY THIRTEEN ground water basins along the California coast have been damaged and others are being threatened by the encroachment of saline waters from the ocean or inland bays. To meet this threat, the State Water Resources Board began an investigation of ways of controlling or preventing sea water intrusion. As a part of that investigation, the University of California on January 1, 1952, undertook a program of research on sea water intrusion into fresh ground water sources and methods of its prevention. The work of the University was confined to the determination of theoretical relationships and to laboratory research. This report covers work done on the basic parameters of sea water intrusion, on the hydraulics of injection wells, and on the construction of impermeable cutoff walls.

It is well known that the fresh water piezometric surface must be maintained above sea level in order to prevent the encroachment of saline water into an aquifer which has direct access to the sea. In the course of the studies theoretical relationships were derived which give the distance above sea level to which the piezometric surface must be raised in order to halt the intrusion, as well as the amount of seaward fresh water leakage to be expected under these conditions for an aquifer of known characteristics. Also a theory was developed which shows that a line of injection required for aquifers under different hydraulic conditions can be predicted.

In order to confirm this and other theories, a model pressure aquifer six inches high, three inches thick, and four feet long was constructed of Lucite. It was packed with a clean quartz sand, and provision was made for introducing fresh and salt water through either of two end chambers or through either of two model injection wells. The salt water was distinguished from the fresh by fluorescent dyes, and the interface could be observed both in a plane through an injection well and in a plane midway between injection wells. Experimentally the sea water was observed to enter the aquifer as a wedge along the lower boundary and to move to an equilibrium position which depended on the seaward rate of fresh water flow. The position and movement of this intruded sea water wedge were recorded for various rates of seaward fresh water flow, and also for various rates of overdraft. Later the effect of injecting fresh water into the zone of intrusion and into the aquifer inland from the sea water interface were observed. Preliminary studies were also made of a pumping trough, using the model wells to extract water from the aquifer in amounts sufficient to intercept all of the intruding sea water. Incidental data, such as the relative effect of diffusion that may be expected, were also obtained. Throughout many of the experimental runs an automatic lapse-time motion picture camera was used to obtain a continuous record of the position of the interface.

The principal conclusions which may be drawn from the experimental data obtained in studies of sea water intrusion include the following:

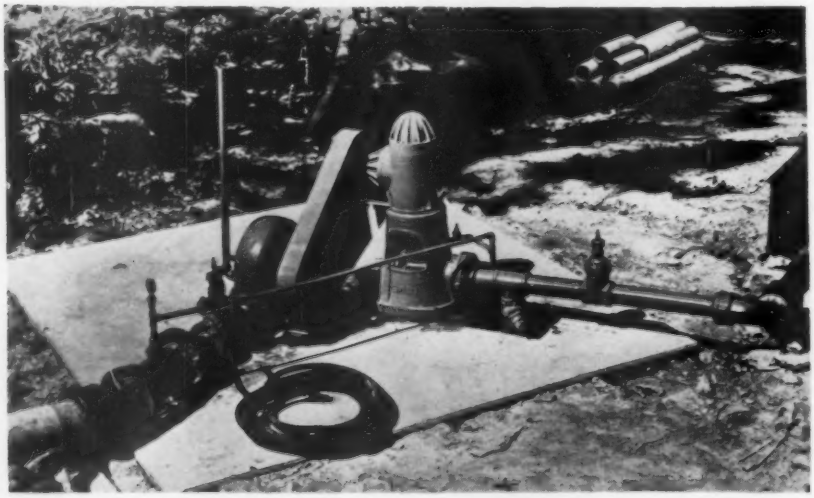
1. In order to prevent sea water from entering an aquifer which has direct access to the sea, the fresh water piezometric surface must be held above sea level a distance equal to (S-1) times the distance below sea level to the lowest pumping zone which must be protected, where S is the specific gravity of the ocean or inland bay water.

2. For aquifers of finite thickness, the maintaining of a fresh water surface above sea level will result in a seaward leakage of fresh water in the upper portions of the aquifer. A sea water wedge will form in the lower portion, extending inland from the ocean outlet a distance which is inversely proportional to the fresh water flow rate. For a uniform aquifer this seaward leakage may be determined from formulas given in the report; for non-uniform aquifers methods are given for its estimation.

3. The relationship between the equilibrium wedge length and the rate of seaward flow of fresh water is independent of the distance of the aquifer below sea level.

(*Continued on page* 154)

Town Pumps Water Without Power Cost



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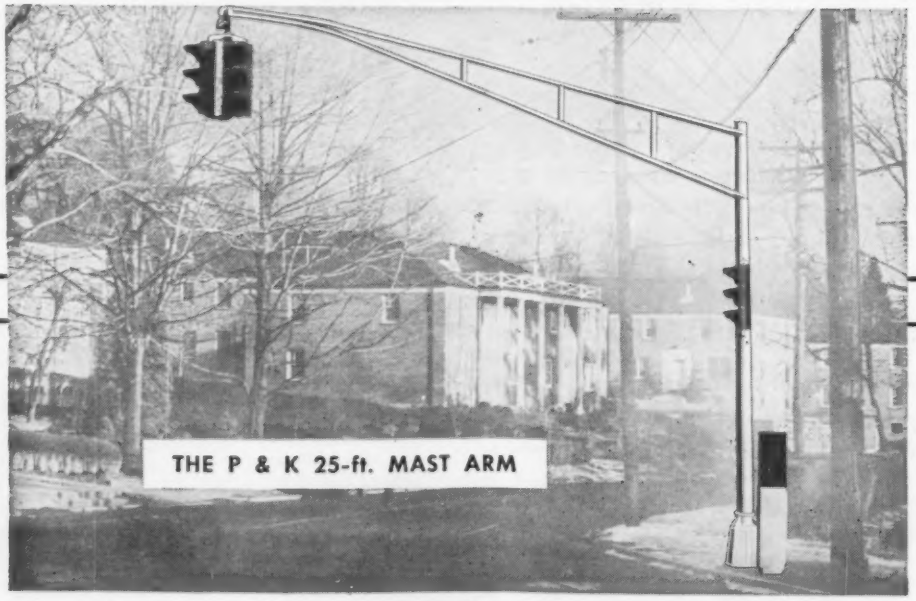
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Ohio Incinerators

(*Continued from page* 102)

to plan for the construction of an incinerator plant and in 1935 the city inaugurated the process of incineration as a means of disposing of its household refuse.

The original incinerator plant, costing $875,000 is still in operation; however, in January, 1954 it was converted to hydraulically operated stokers purchased at a cost of $196,000. This increased the rated capacity to 1200 tons per 24 hours. During 1954, 247,350 tons of garbage and burnable refuse were incinerated at a payroll cost of $474,034.84 or approximately $1.92 per ton. The incinerator is in operation twenty-four hours daily, seven days a week.

Four smaller municipalities in the Cleveland area have contracted for the disposal of their burnable household refuse at the rate of $4.00 per ton. These contracts are on a temporary basis until construction of their own incinerator plants can be completed.

Cincinnati—The city of Cincinnati (population 503,998) has had three incinerator plants in operation for the disposal of combustible wastes and wrapped garbage since June 1, 1931. The original construction of the central incinerator was a $250,000 project with one 200-ton unit and one 100-ton unit. The plant was reconstructed in 1936 at a cost of $120,000. The reconstruction work included replacing the 100-ton unit with a 200-ton unit and the installation of an additional 300 H.P. coal fired boiler, and the installation of under-feed stokers to eliminate hand firing of the boilers. The present rated capacity is 400 tons.

In 1954 the west fork incinerator was constructed to replace the central plant. This plant with a capacity of 500 tons per 24 hours was erected at a cost of $1,527,600. The plant has four furnaces with a capacity of 125 tons per 24 hours and circular type, mechanical stoking combustion chambers. The west fork plant is the storage pit and crane type of operation. The storage bin has an over-all capacity of 600 tons. Two cranes are utilized, both with a 1¼ cubic yard grab bucket and 3-ton capacity.

The actual operation of the plant has been laid out to allow for the maximum use of the facilities. Each truck entering the plant is weighed. Waste is then dumped in the receiving bin. Nine trucks are able to unload at one time. The cranes then come into use transferring the waste from the bin to the charging hopper.

Waste enters the furnace where it is burned. The remaining residue ash is dropped through the grate into the ash pit, cooled by a water spray, emptied into a truck and hauled to the landfill.

Gases of combustion pass into the combustion chamber where they continue to burn at a temperature of approximately 1900 degrees Fahrenheit; some fly-ash is deposited. Gases then enter the expansion chamber where they cool and drop the remaining fly-ash. Approximately 10 cubic yards of fly-ash is removed from each of the four combustion and expansion chambers on weekly clean-outs.

Total cost for operating all incinerators including labor, equipment, supplies and contract services is $441,899.70 or a total unit cost of $2.05 per ton. In 1954 with the central plant operating through November the city incinerated a total of 215,959.9 tons of refuse.

Lima—The Lima incinerator has been in operation since March of 1953. Previously, the city (population 50,246) operated the open dump with private haulers delivering refuse and garbage to the area. The plant has a 24-hour capacity of 150 tons and with the exception of nonburnables which are disposed of at a dump, handles all garbage and refuse of the city. Original cost of the plant was $400,000.

Other Ohio municipalities are also using incineration to good advantage. Martins Ferry (population 13,220) has been using incineration exclusively since 1927. The average cost of operation per year is $7,500. Lakewood (population 68,071) put its incinerator into operation in 1931. The capacity was doubled in 1951 and it now handles 300 tons in 24 hours. The original plant cost $104,000 and the addition which was a duplicate of the original cost $352,000 including engineering fees and construction. The average cost of operation over the past three years including operation and maintenance was $52,330, or a cost of approximately $1.59 per ton of refuse incinerated.

No longer is it necessary to look upon the refuse disposal service as a necessary evil that must be performed. With the modern building designs and improvements made by the major manufacturers of incinerators the problem of refuse disposal can be handled efficiently and with the greatest respect for the health and welfare of the citizens.

This is a condensation of a report from *Ohio Cities and Villages* published by The Ohio Municipal League.

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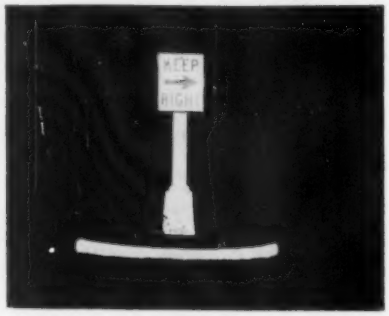
PUBLIC WORKS
EQUIPMENT NEWS

Published Monthly November, 1955

Reflective Liquid Marks Hazards and Obstructions

Reflective liquid may be painted or sprayed on wood or concrete surfaces



Night view shows how effectively the curb and post have been reflectorized

A new reflective liquid, which can be painted or sprayed directly on wood, concrete and other rough or porous surfaces, has been introduced by Minnesota Mining. Called "Codit" it is recommended for overall reflectorization of median dividers, underpass abutments and walls, culverts, safety islands, curbings, telephone poles, trees, fire hydrants, guard rails and posts and other objects where nighttime visibility means safer driving. It is light gray in daylight and blends with concrete or other light-colored objects, but at night it reflects back to the driver without glare in bright silver. Further information from Dept. 5-271G, Minnesota Mining and Manufacturing Company, St. Paul 6, Minn., or circle **No. 11-1** on the coupon.

Horizontal Earth Boring Tool Fits 12" Wide Trench

An addition to its line of wet-hole, horizontal earth boring tools has been announced by Hydrauger. This new Hydrauger has been constructed to accomplish the installation of three-quarter inch domestic service connections where the piping extends beneath paved or non-trenchable areas. The entire machine sets within a twelve-inch trench and weighs eighty pounds; it develops 3 hp on 85 psi air supply. For further information write Hydrauger Corporation, 681 Market Street, San Francisco, Cal., or circle **No. 11-2** on the coupon.

Air-powered unit places services connections beneath sidewalks and drives

Allis-Chalmers Bottom Dump Motor Wagon

A new hydraulically operated bottom dump motor wagon, the TW-360, has been added to the Allis-Chalmers line of earthmoving and construction machinery. This new 47,000-lb. unit is powered by the Allis-Chalmers 280 hp Diesel engine providing forward speeds ranging from 3 mph in first, to 20 mph in fourth gear. The Motor Wagon, with a 22-ft. wheel base, has a 22-cu. yd. heaped and a 17-cu. yd. struck capacity, or 26 tons. Write to Allis-Chalmers Mfg. Company, Milwaukee, Wisc., or circle **No. 11-3** on the coupon.

Flow Integrator Uses Centrifugal Principle

The new Model 14A Pneumatic Integrator, designed by The Foxboro Company, is unique in that it requires no cams for square root extraction and the new device provides continuous linear integration of industrial process flows to within ½-percent accuracy. A flow change is instantly reflected in a change of wheel speed and a rebalancing of forces. The centrifugal principle extracts the square root factor introduced by the differential pressure measurement so that integration of flow is linear. The device is weatherproof, dust-proof and self-purged; can be panel or field mounted. Gears are replaceable for whatever unit of flow measurement is desired. All circuits are pneumatic; conventional 20 psi air or gas supply required. For full details write The Foxboro Company, Foxboro, Massachusetts, or circle **No. 11-4** on the coupon.

New 5,000-Lb. Lift Truck

The Hyster HC-50 lift truck, a compact, highly maneuverable 5,000 lb. unit is announced by Hyster. The unit's outside turning radius is 79 inches and its short length, narrow width and ease of steering contribute to faster on-the-job output. The weight is 7110 lbs. and powered by Waukesha gasoline engines, Diesel engine, LP Gas Conversion Kit, Hystamatic drive and Hyster free lift are optional features. Additional information from Hyster Company, 2902 N. E. Clackamas Street, Portland 8, Oregon, or by circling **No. 11-5** on the coupon.

The Right Salamander for Any Job

A No. 1415 Salamander equipped with new safety shutoff and pilot light has been announced by Insto-Gas. The No. 1415 has a pressure regulator mounted on the salamander which makes it unnecessary to have the fuel cylinder nearby. It also has well-engineered heat distribution plus a secondary heat reflector skirt that radiates heat upward, where it is needed. For more information write Insto-Gas Corporation, 1977 East Woodbridge, Detroit 7, Mich., or circle **No. 11-6** on the coupon.

Compact Insto-Gas salamander gives plenty of heat wherever you need it

Low Clearance Krawloader

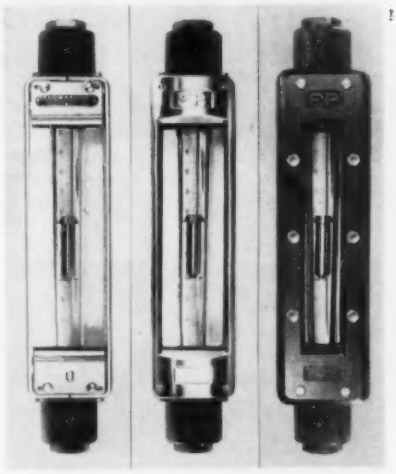
A compact, low clearance Krawloader for use on the John Deere 40-C 5-roller tractor is now being manufactured by Henderson Manufacturing Company. The unit features a rugged box-section main frame, double-action cylinders with V-packing and chromed rods, a powerful front mounted vane type hydraulic pump, auxiliary relief valve, oil filter and control valves. The full protective grill guard, high pressure wire braid hose, oversize linkage and pivot points are other outstanding features. The Krawloader is available for 46-inch Ga., 12-inch Maximum Track Shoe, and for 44-inch Ga., 10-inch Maximum Track Shoe. Full information from Henderson Mfg. Company, Inc., Cedar Rapids, Iowa, or by circling **No. 11-7** on the coupon.

All-Aluminum Flatbed Trailer

A radically new, all-aluminum welded flatbed truck trailer with more than 3,000-pound increased maximum payload has been developed by Kaiser Aluminum & Chemical. The trailer is 35 ft. long and has a total weight of 7,986 pounds and payload of 45,000 pounds. For full details write Kaiser Aluminum & Chemical Corporation, 1924 Broadway, Oakland 12, Calif., or circle **No. 11-8** on the coupon.

Flowmeters Feature Simplified Frame Design

A new series of variable area flowmeters with simplified design features, strong construction and good visibility of the metering tube are announced by Fischer & Porter. The improved design uses one basic frame which can be made into an enclosed or pressure-sealed meter and the enclosed meter is made of corrosion-resisting stainless steel. The increase in tube visibility allows the meter to be read from a much wider angle than before. An improved packing assembly is available in either Neoprene or in a hat-type Teflon glass-to-metal seal with Neoprene compression rings. Information from Fisher & Porter Company, Hatboro 35, Pa., or circle **No. 11-9** on the coupon.



Various meter types use same frame

Pulsating Red Signals Command Attention

A new concept of traffic signal identification, a rapidly pulsing red light, has been offered by Southern Signals. The new identification operates on a fourth section set above the red indication on a standard traffic signal or directly to the red indication itself. The 340-420 pulses per minute, "Pulsating Red", stands out effectively against a distracting background of electric signs and is not affected or washed-out by the sun. It catches the drivers' eyes from greater distances thus preparing him much sooner to take the necessary action to stop safely. For full details write Southern Signals, Inc., Shreveport, La., or circle **No. 11-10** on the coupon.

Pulsating signal stands out from background distractions

Mixing Unit Reduces Dust on Gravel Roads

A new delivery conveyor attachment that thoroughly mixes water and calcium chloride with aggregate, before it is discharged from surge bins or gravel plants into a truck body, has been announced by Iowa Manufacturing. The Cedarapids mixing unit eliminates the need of other sprinkling or spraying equipment on the road bed and provides much more accurately controlled proportioning of calcium chloride and moisture than is possible with surface mixing methods. It fits under the head pulley of a delivery conveyor. For information write Iowa Manufacturing Company, Cedar Rapids, Iowa, or circle **No. 11-11** on the coupon.

Allis-Chalmers New HD-6 Series Tractors

Two new HW-6 series tractors, the bulldozer-drawbar tractor and the tractor shovel, have been announced by Allis-Chalmers. New basic design includes plenty of power, balance throughout the tractor, strength in all components, weight in the working parts and big safety factors. One-piece steering clutch and final drive housing, roller bearing truck wheels with idlers and supports, heavy-duty diesel engine, wrap-around radiator guards and welded steel frame are a few of the features available. The tractor-shovel has a bucket capacity of 1 1/3-cu. yd. For complete information write Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin, or circle **No. 11-12** on the coupon.

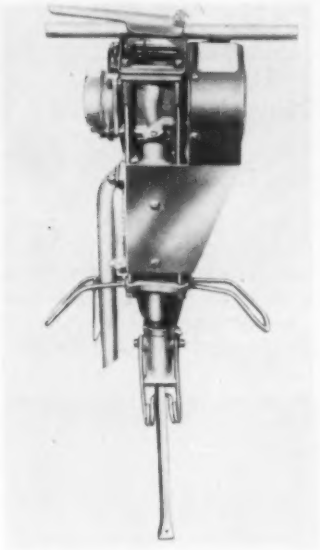
Borer Cuts Under Walks and Drives

A newly engineered underwalk and driveway borer has been announced by Mall Tool. This earth borer makes a 2-inch diameter hole straight through the soil, under concrete sidewalks, and even under wide driveways. The borer head stays on a steady, level course all the way making an easy and quick method of laying underground piping and wiring. It is easy to handle and to operate and its portability is provided by rubber tired wheels. This type of machine solves the costly bottlenecks confronted daily in laying pipe and conduit under sidewalks, drives and runways. For further information write the Mall Tool Company, 7725 South Chicago Avenue, Chicago 19, Illinois, or circle **No. 11-13** on the coupon.

Vibratory earth borer makes a 2-inch diameter hole without removing soil

Gasoline Hammer Rock Drill

A self-contained gasoline hammer rock drill has been added by Syntron to its line of power tool equipment. The Model RD-55 can drill to a depth of thirteen feet at a rate of approximately two feet per minute when using Syntron hollow drill steels with carbide tips. Three sets of Hollow Carbide drill steels are available for this new model. Short sets use 2, 4 and 6-foot steels with 1 3/16″ to 1⅜″ diameter bits. The long sets use 8, 10 and 13-foot steels with 1 3/16″ to 1¼″ diameter bits. Complete information from Syntron Company, 660 Lexington Avenue, Homer City, Pa., or circle **No. 11-14** on the coupon.

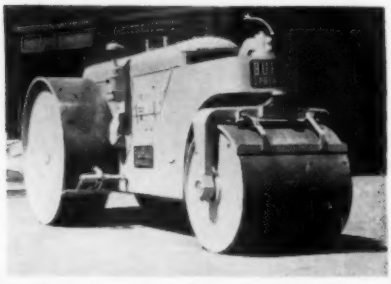


New Cat Traxcavator With 1-yd. Capacity

The new Cat No. 933 Traxcavator announced by Caterpillar has a 1-cubic yard bucket and is in the D2 crawler Tractor class. Such features as unit design, 40 degree bucket tilt-back at ground level, excellent horsepower-to-weight ratio, advanced hydraulic system, large lifting capacity, good balance and stability as well as operator convenience and visibility, fast response to controls, in-seat starting and oil flywheel clutch are included in this tractor-shovel. For more information write Caterpillar Tractor Company, Peoria, Ill., or circle **No. 11-17** on the coupon.

Power Brakes on 3-Wheel Road Rollers

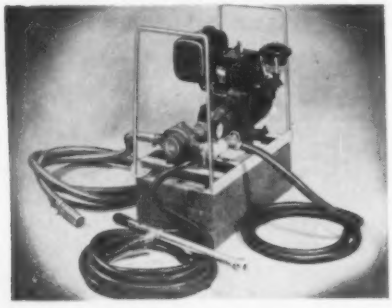
Power brakes on 3-wheel road rollers has just been announced by Buffalo-Springfield. Vacuum hydraulic powered brakes on both the drive rolls, and a mechanical parking brake mounted on the transmission, provide complete and positive braking control on the 10-14 ton and 12-15-ton heavy-duty variable weight 3-wheel rollers. Other engineering features include 4-speed transmission, special torque-proportioning bevel gear differential, high-speed, low-torque clutches and improved hydraulic steering system. Full data from Buffalo-Springfield Roller Company, Springfield, Ohio, or circle **No. 11-18** on the coupon.



Engineering features on this three-wheel roller include new power brakes

Portable Spray Speeds Roadside Maintenance

A portable spraying unit designed for road and building maintenance work has been introduced by Larson Machine. The unit comes in two sizes: one with a 3-hp gasoline engine driving a high speed nylon roller pump to develop 150 lbs. pressure; the larger 3½-hp engine develops 300 lbs. pressure. The entire unit is housed in a compact welded steel frame for easy placement in the rear of maintenance trucks. For full details write Larson Machine Company, Princeville, Ill., or circle **No. 11-15** on the coupon.



This portable Larson sprayer handles chemicals for weed and insect control

New Developments in Crawler Tractor

A new all-hydraulic instant-shift transmission and torque converter drive are new developments announced by American Tractor on its crawler tractors. The new Terramatic transmission provides 4 speeds forward up to 5.63 mph and 4 speeds reverse up to 6.2 mph. It permits full power-turns with the touch of a finger or smooth pivot-turns with hydraulic foot brakes. Complete details from American Tractor Corporation, Churubusco (Ft. Wayne), Ind., or Circle **No. 11-16** on the coupon.

Hydra-Hammer with All Weather Cab

A Hydra-Hammer for pavement breaking and compaction work which is equipped with an all-weather cab is announced by Ottawa Steel. The cab has a solid steel roof and is made of 14-gauge reinforced steel throughout. All-around windows give complete 360° vision with safety plate glass. The cab is 5′ 2″ high, 4′ long, 3′ 1″ wide

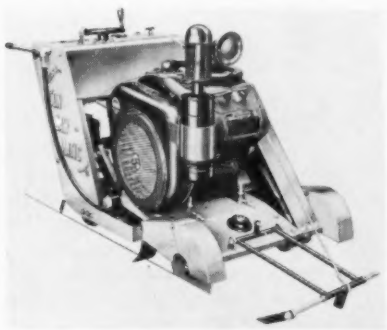
and can be set up quickly with no special skilled workers for machines already in the field. For further information write Ottawa Steel, Div., L. A. Young Spring & Wire Corp., Ottawa, Kansas, or circle **No. 11-19** on the coupon.

An Economical Salt Spreader Unit

A salt spreader that can be rigged in one minute by one man has been introduced by Spin-Zit. This unit is capable of saving from 35 to 50 percent on the cost of the use of salt. The automatic bag opener is very important. Just throw the bag of salt under the screen and it automatically breaks and goes into the salt hopper. For full details write Spin-Zit Salt Spreader Co., Box 829, New Bedford, Mass. or circle **No. 11-20** on the coupon.

Clipper Introduces New Concrete Saw

Clipper's all new self-propelled Concrete Saw, Model C-360, combines 36-hp with automatic retractable turning wheels. Dual caster wheels take over the load whenever the blade is raised out of the cut. For straight-line cutting the saw moves forward on four solid rubber-tired wheels, true in cut without drifting to either side. It can operate at speeds up to 26 feet per minute. For information write the Clipper Manufacturing Company, Suite 745, Kansas City 8, Missouri, or circle **No. 11-21** on the coupon.



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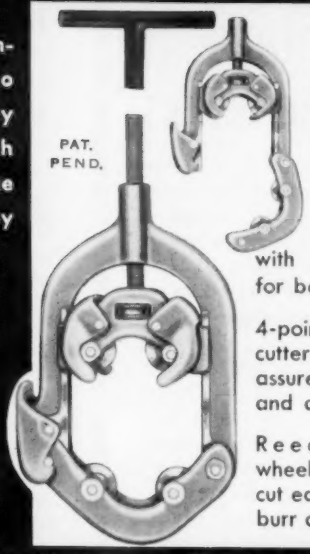
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



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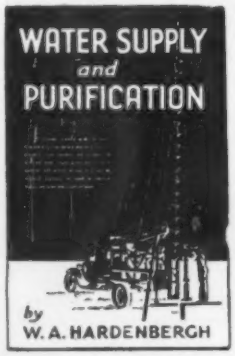

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Sea Water Intrusion

(*Continued from page* 144)

4. There is no marked change in the shape of the fresh water-sea water interface at the beginning of an overdraft period. From any initial position the interface moves inland at a rate determined by the rate of fresh and salt water movement. In a uniform aquifer, the wedge tends to flatten out and the toe tends to move somewhat faster than the interface as a whole, due to the greater density of the salt water. In most prototype aquifers, however, the uncertainties of non-uniformity within the aquifer make it impossible to generalize on the rate of intrusion, since the sea water may enter the more permeable portions and travel relatively rapidly within them.

5. If fresh water can be injected into the aquifer at a sufficient rate, the piezometric surface can be maintained at the required height above sea level in a region along the coast. The spacing of the wells is of little importance, except that the toe of the intruded wedge should be held at least half a well spacing seaward from the centerline of the wells. The seaward fresh water leakage will be related to the length of the sea water wedge in the same way as before. However, unless the inland demand for fresh water is reduced, the injection rate must equal not only the leakage rate, but also the entire overdraft rate which has originally caused the intrusion.

6. If fresh water is injected on top of the wedge at a rate sufficient to halt intrusion, the portion of the wedge extending inland from the wells will be cut off. It continues to move inland depending on the hydraulic gradient existing there, but its rate of travel will be no greater, and actually will be somewhat less, than the rate of travel of the entire wedge under the same overdraft conditions.

7. Unless there is a pronounced impediment to vertical flow within the aquifer the injection of water near the bottom of the aquifer provides no benefits in the form of a reduced leakage rate.

8. Intruding sea water can be intercepted by a line of pumping wells, which would form a "pumping trough" near the coast. There would be no recharge benefits from this plan, but under proper operation the seaward leakage of fresh water need be no greater than in the injection process.

Bentonite slurry as an additive to backfill mixtures did not meet original expectations.

From the results of laboratory tests with impermeable cut-off walls the following conclusions are justified:

1. Bentonite slurry of a consistency ordinarily used in drilling operations is not a satisfactory additive to backfill mixtures containing up to 30 percent silt.

2. Stiffer slurries, containing from seven to eight percent dry bentonite, promote a satisfactorily low permeability coefficient in well-graded backfill mixtures containing from 15 to 30 percent silt.

3. It is unlikely that excavation equipment can operate in these thick slurries; even tetrasodium pyrophospate was unable to reduce their viscosity appreciably. Unless some material is found that will act in conjunction with the thinner trench slurry to form a satisfactory additive, a separate source of slurry must be used with the backfill mixture.

4. Only enough slurry should be added to the backfill mixture to obtain minimum workability; any additional amount raises its permeability and contributes to the danger of piping. For this reason a method of backfilling should be selected which will allow a minimum amount of water or trench slurry to be incorporated in the mix during placement.

5. Preliminary data indicate that the permeability to sea water of a mixture incorporating bentonite slurry is roughly ten times its permeability to fresh water.

6. No mixture was found which provides a complete seal. The residual leakage may be determined from the permeability value for the barrier and from a knowledge of ground water elevations obtaining on each side. The resulting damage would depend on the diluting effect of fresh water flow into the basin and on the amount of water exported.

This summary and conclusions were from a Report on Laboratory and Model Studies of Sea Water Intrusion prepared by the Sanitary Engineering Research Laboratory, University of California. The studies were conducted by a Faculty Committee and a Research Staff comprised of Sanitary, Civil, Hydraulic Engineers, Scientists and other technical men.

PERSONAL NEWS

DR. JOHN D. FRAME, formerly a Research and Project engineer for Metcalf and Eddy, has been appointed to the Sales Engineering staff of F. S. Gibbs, Inc., Newton Lower Falls, Mass. He will work in the field on the Gibbs Flotation Units as applied to sanitary and industrial uses.

H. E. BOVAY, Jr., Consulting Engineers of Houston, Texas, and Spokane, Wash., have recently moved into their own new and modern office building at 5009 Caroline St., Houston. Members of the firm, in addition to Mr. Bovay, include B. W. Burns, C A. Lawler and R. B. Robertson.

RICHARDSON, GORDON & ASSOCIATES is the name of the new partnership for consulting engineering. This includes George S. Richardson, Bennett T. Gordon, James H. Morehouse and James C. Fisher. Offices are maintained at 3 Gateway Center, Pittsburgh and 1411 Walnut St., Philadelphia.

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New hydraulically operated backhoe converts Agricat into efficient digging tool . . . cuts costly hand labor! Equipped with 9" or 12" bucket, AGRIHOE reaches 10 feet, digs 6 feet, loads to 8-ft. heights.

Agricat is available with short or long track . . . may also be equipped with High Lift Bucket or Dozer attachments.

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INDEX OF ADVERTISEMENTS

Abrams Aerial Survey Corp. 147
Acker Drill Co., Inc. 122
Air Survey Corp. 147
Alabama Pipe Co. 34
Albright & Friel, Inc. 147
Allis-Chalmers Co. ..... 15 to 19
Alvord, Burdick & Howson 147
American Hot-Dip Galvanizers Asso. 127
American-Marietta Co. 23
Armco Drainage & Metal Products Inc. 14
ARPS Corporation 126
Asplundh Chipper Co. 111
Ayer-McCarel Clay Co., Inc. 109

Badger Machine Co. 21
Badger Meter Mfg. Co. 47
Baker, Jr., Michael 147
Bannister Engineering Co. 147
Barber-Greene Co. 43
Barker & Wheeler 147
Bell, Howard K. 147
Black & Veatch 147
Bogert and Childs 147
Bowe, Albertson Assoc. 147
Bowerston Shale Co. 109
Brown & Blauvet 147
Brown Engineering Co. 147
Browne & Associate, Floyd G. 147
Buchart Engineering Corp. 147
Buck, Sifert & Jost 147
Burgess & Nipple 147
Burke, Inc., R. H. 147
Burns & McDonnell Engr. Co. 147
Byron Jackson Division 33
Borg-Warner Corporation

Caird, James M. 147
Calgon Inc. ..... 27 & 60
Camp, Dresser & McKee 147
Cannelton Sewer Pipe Co. 109
Capitol Engineering Corp. 147
Cast Iron Pipe Research Assoc. ..... 12 & 13
Cataphote Corp. 50
Caterpillar Tractor Co. ..... 4 & 70
Chester Engineers 147
Chicago Pump Co. 3
Classified Ads 154
Cleveland Trencher Co. 64
Clow & Sons, James B. ..... 30 & 46
Cole & Son, Chas. W. 147
Combustion Engineering, Inc. 31
Computer-Measurements Corp. 34
Consoer, Townsend & Assoc. 148
Cotton, Pierce, Streander, Inc. 148

Darley & Co., W. S. 154
DeLeuw, Cather & Co. 148
Detectron Corp. 34
Dickey Clay Mfg. Co., W. S. 109
Dietz, R. E. Company 54
Dotmar Industries Inc. 124
Dresser Industries, Inc.
(See Roots-Connersville Blower Corp.)
(See Dresser Mfg. Div.)
Dresser Mfg. Div. 35
Dratt Mfg. Co. ..... 28 & 29

Enterprise Engine & Machinery Co. 37

Federal Sign & Signal Corp. 48
Fisher Research Lab., Inc. 125
Fitchburg Engineering Corp. 22
Flexible Inc. 140
Ford Meter Box Co. 130
Ford Motor Company
Tractor & Implement Div. 51
Foster Engineering Co. 56
Foxboro Company 61
Fridy, Gauker, Truscott & Fridy, Inc. 148
Frink Sno-Plows, Inc. 36

Galion Iron Works & Mfg. Co. 2
Gannett, Fleming, Cordroy & Carpenter, Inc. 148
General Electric Company ..... 67 to 69
Outdoor Lighting Dept.
Gilbert Associates Inc. 148
Golden Anderson Valve Specialty Co. 158
Graver Water Conditioning Co. 39
Greeley & Hanson 148
Green Co., Howard R. 148
Greenlee Tool Co. 157
Greer Engineering Associates 148
Gruendler Crusher & Pulverizer Co. 141

Hagan, Inc. ..... 27 & 60
Hamilton Kent Mfg. Co. 59
Harley & Assoc., Frank E. 148
Harte Co., John J. 148
Havens & Emerson 148
Hazen & Sawyer 148
Heitzel Steel Form & Iron Co. 26
Hill & Hill 148
Homelite Corp. 41
Homestead Valve Mfg. Co. 139
Hooper, William T. 148
Hotel Pitsburger 155

Hough Co., Frank G. 49
Hunt Machine Company, Rodney 63
Hydrauger Corp., Ltd. 106

International Harvester Co. ..... 28 & 29
International Salt Co., Inc. 65

Jaeger Machine Co. 57
Johns-Manville 143
Jones, Henry & Williams 148

Katolight Corporation 153
Keasbey & Mattison 52
Kennedy, Clyde C. 149
Kerrigan Iron Works, Inc. 11
Knowles, Inc., Morris 149
Kwik-Mix Co. 42

Layne & Bowler Pump Co. 20
Leopold, F. B. 50
Le Roi 55
Div. of Westinghouse Air Brake Co.
Le Tourneau-Westinghouse Co. 110
Lewis, Harold M. 149
Link-Belt Co. 6
Lozier & Co., Wm. S. 149

M & H Valve & Fittings Co. 114
McWane Cast Iron Pipe Co. 134
Maxim Silencer Co. 106
Metcalf & Eddy 149
Monarch Road Machinery Co. 122
Morse Bros. Machinery 66
Mueller Co. ..... 8 & 9

Natco Corp. 109
National Clay Pipe Mfrs., Inc. 107
Nichols Engineering & Research Corp. 117
Northern Gravel Co. 40
Norton Company 159

Pacific Flush Tank Co. 113
Pacific States Cast Iron Pipe Co. 134
Palmer & Baker, Inc. 148
Pence & Co., Inc., Earl H. 155
Permutit Company 53
Pfaff & Kendall 146
Phelps, Inc., Boyd E. 149
Pirnie Engineers, Malcolm 149
Pitometer Company 149
Pittsburgh Des Moines Steel Co. 131
Pittsburgh Equitable Meter Div. 129
Pomona Terra-Cotta Co. 109
Portland Cement Assn. 145
Preload Company, Inc. 108
Public Works ..... 122, 130 & 158

Ranney Method Water Supplies Inc. 127
Reed Mfg. Co. 153
Rensselaer Valve Co. 133
Div. of The Ludlow Valve Mfg. Co., Inc.
Roberts Filter Mfg. Co. 153
Roberts & Co., Assoc. 149
Rockwell Co., W. S. 135
Rockwell Manufacturing Co. 129
Royer Foundry & Machine Co. 138
Russell & Axon 149

Seaman-Andwall Corp. 10
Seay Co., Irby 149
Sherman Products, Inc. ..... 118 & 119
Smith & Gillespie 149
Smith & Loveless 38
Sparling Meter Co. 44
Spin-Zit Salt Spreader Co. 42
Standard Dry Wall Products 115
Stanley Engineering Co. 149
Stilson Assoc., Alden E. 149

Tarrant Mfg. Co. 124
Taylor & Co., W. A. 142
Tennessee Corp. ..... 24 & 50
Texas Vitrified Pipe Co. 109
Tilden Tool Mfg. Co. 141
Trickling Filter Floor Institute 109
Trojan Mfg. Co. 40

U. S. Pipe & Foundry Co. 137
Uhlmann & Associates 149

Vermeer Mfg. Co. 44

Wallace & Tiernan Co., Inc. ..... Back Cover
Watkins, J. Stephen 149
Wayne Mfg. Co. 121
Weil Pump Co. 132
Westinghouse Electric Corp. 123
Weston Co., L. A. 142
White Motor Company 45
Whitman, Requardt & Assoc. 149
Wilkinson Products Co. 156
Wolverine Tube
Division of Calumet & Hecla, Inc. 25
Wood Co., R. D. 116
Worthington Corp. 58
Wyandotte Chemicals 62
Wylie Mfg. Co., Inc. 125

—Worth Seeing

Parking meters keep on collecting for Clifton, N. J., with their Nelson Iron Works loader on the job. Scenes like this soon will be common throughout the snow belt.

It's a far cry today from the time when cast iron pipe was called "a chunk of pig iron with a hole in it." Here is the Golden Anniversary view on one major foundry where progress has been continuous, that of the American Cast Iron Pipe Company in Birmingham, Alabama. The full story of pipe progress is in a book "People and Pipe" which American will be happy to send on request.

215,000 square feet of precast concrete roof deck features the new Maintenance and Traffic Depot of Massachusetts' Department of Public Works. There are 8,000 similar decks in the country. Photo courtesy Precast Concrete Roof Deck Mfrs.

"Pipe installation time and labor costs cut about 50% with Greenlee Pipe Pusher"

That's what a leading eastern utility reports as its experience with a GREENLEE Pipe Pusher on jobs as shown above. Let this remarkable tool make big timesavings and reduce job costs for you, too. With the GREENLEE Pusher, *one* man pushes pipe *under* streets, walks, floors, railways, lawns, etc. Eliminates extensive trenching and time-consuming tearing up, tunneling, backfilling, repaving. Often pays for itself on the first few jobs. Two models: No. 790 for pushing ¾" to 4" pipe; No. 795 for larger pipe and concrete ducts.

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YOUR PLANT WITH
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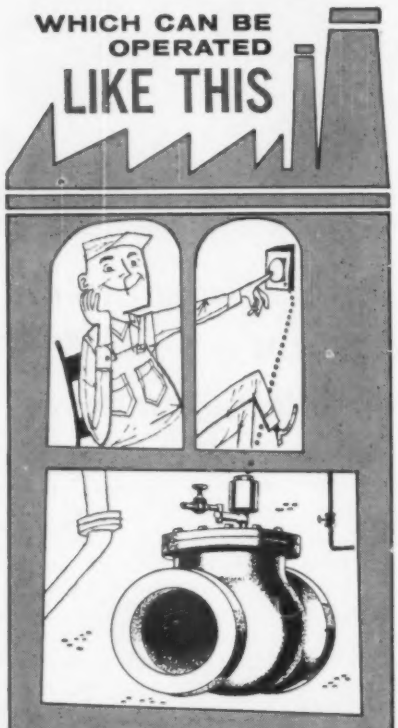


✓ or by many other types of electrical impulse

✓ Use the angle body and save the price of an elbow fitting

✓ Positive Control

✓ Sizes ½" thru 36"

✓ Used on Water, Oil, Air and Many Other Liquids

BULLETIN W-7 HAS THE TECHNICAL FACTS
WRITE FOR IT TODAY

GOLDEN ANDERSON
Valve Specialty Company
1244 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of
VALVES FOR AUTOMATION

WORTH TELLING

by Arthur K. Akers

★ IF you haven't yet changed our address from New York to 200 South Broad St., Ridgewood, N. J., please do it now. This is our first issue edited in our own new building in this suburban location 12 miles due west of the George Washington bridge and we are still wondering why we did not make this move long ago!

★ NATIONAL Clay Pipe Association has done some moving, too, and is now at 1820 N Street, N.W., Washington.

★ THE Water and Sewage Works Manufacturers Association, 170 Broadway, New York 38, has brought its file of available films up to date. Please address them for the list which—happily for you—is too long to print here. They are for loan and/or rent.

★ JOHNS-MANVILLE Sales Corporation has split its Industrial Products Division into three new operating ones. General Manager of the new Transite Pipe Division will

Mr. Orth

Mr. Wahl

be Robert F. Orth, now with rank of vice-president. Included in his staff are George R. R. Wahl, merchandise manager, and John H. Goodwin, general sales manager, both of whom have also been elected vice-presidents.

★ BYRON JACKSON Company (pumps) is now merged with Borg-Warner Corporation, as is Brooks Equipment and Mfg. Co. of Knoxville. J. L. Stewart becomes assistant regional manager for Byron Jackson at Houston.

★ BAILEY METER CO., Cleveland, names R. W. Duensing to head their water and waste treatment division.

★ REAR ADMIRAL John G. Johns (ret.) is now manager of the Washington engineering office of Enterprise Engine Division, San Francisco, makers of Diesels.

Mr. Hartenstein

★ DISTINGUISHING the recent national meeting of the Illuminating Engineering Society, in Cleveland, was the address of President - elect R. F. Hartenstein. During his term, beginning October 1st, he will head a 23-man council of men widely prominent in electrical lighting affairs.

★ LINDE AIR PRODUCTS Division expects to be in production of silicones at their new $14 million plant at Long Reach, W. Va., this fall. In our ignorance we knew little of silicones but it now appears that they have a big place in making water repellents for masonry and defoaming agents.

★ IF you have an insect to control —or a million—you will be interested in learning that C. E. Campbell is now technical representative for the Washington, D. C., area of Velsicol Chemical Corporation, Chicago. And insects tremble at the very name of Velsicol!

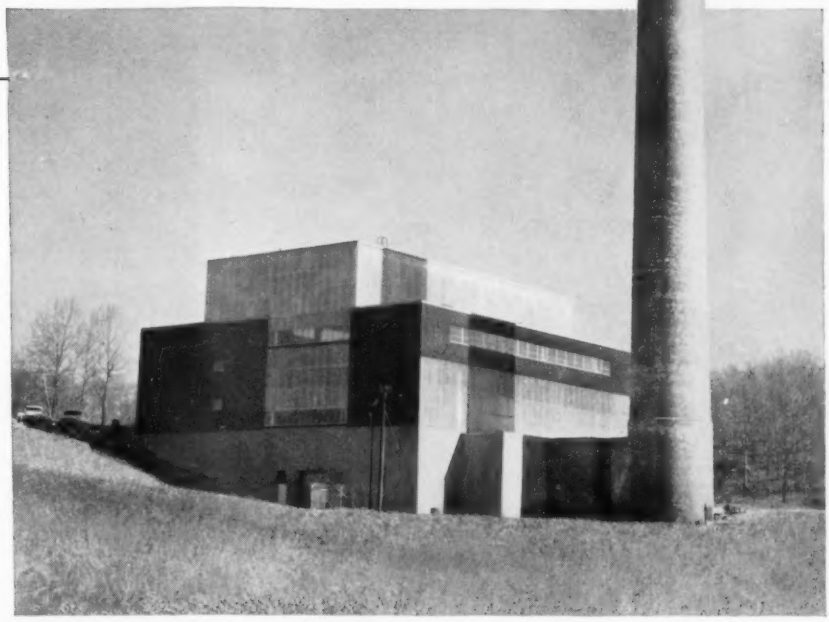
★ THE UNION METAL Mfg. Co., Canton, Ohio, makers of lighting standards, sign standards, etc., will make a million-dollar expansion in buildings and equipment.

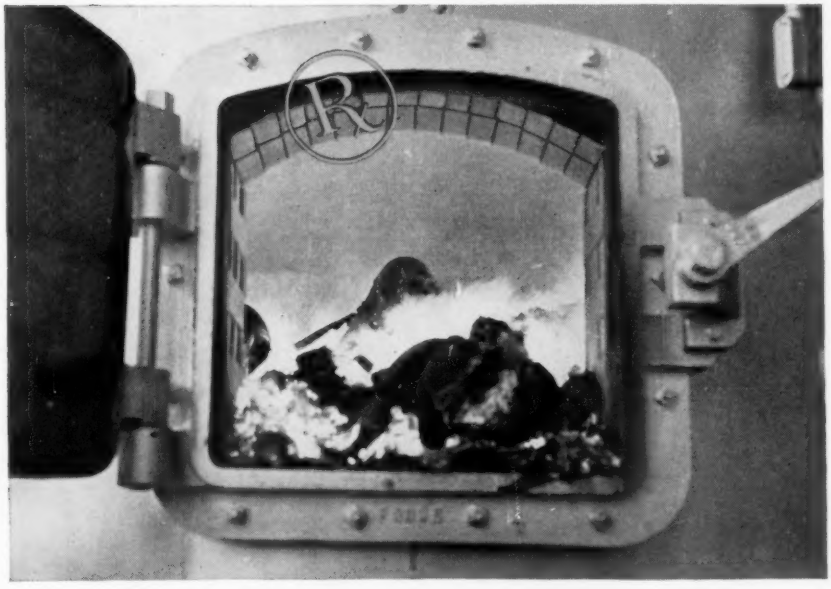
★ ALFRED G. PERKINS moves up to vice-president and sales manager, The Centriline Corporation, water main lining specialists, New York.

★ LAZINESS raised to the n'th degree: A Kentucky mountaineer roused sufficiently to say to his torpid son, "Boy, step outside and see if hit's a-raining." Without stirring the son replied, "Aw, Pa, why don't we just call in the dog and see if he's wet."

Another Norton ℞ *on the job!*

CRYSTOLON refractories specified for furnace lining and other critical areas in new, million-dollar municipal incinerator*





This new $1,000,000 incinerator — designed by Anderson-Nichols & Co. of Boston, Mass., Consulting Engineers, with equipment designed and constructed by Nichols Engineering and Research Corp., New York, New York — is one of the country's newest and most modern. Norton CRYSTOLON refractory shapes have important uses in its combustion system.

CRYSTOLON refractory brick and special shapes, shown around a furnace access door comprise one of the Norton ℞'s — *engineered and prescribed* refractories — in the new incinerator. CRYSTOLON brick also lines the interior walls up to about three feet above the grate line, and is further used in the settling-out area, between the combustion chambers and stack.

Another good example of how designers and builders of the most modern incinerator and power plants are specifying Norton *engineered and prescribed* refractories.

In this big new incinerator CRYSTOLON brick and special shapes are used around the access door and interior of the furnace, as shown. CRYSTOLON brick is also used, in both solid and checkered construction, to make up the baffle walls in the settling-out area.

CRYSTOLON refractory material in the furnace areas provides great resistance to slag caused by bottles, cans and other abrasive refuse. In the baffle walls it is valuable for its ability to reduce erosion due to fly ash. And in all locations it will withstand temperatures up to 3050°F . . . combines great physical strength with exceptional resistance to thermal shock, slag penetration and chemical attack . . . and has up to 15 times the resistance of ordinary fire clay to erosion and corrosion.

Investigate Norton ℞'s

for your own furnace operations. Learn how they can save you time, work and money. See your Norton Representative or write to NORTON COMPANY, Refractories Division, 230 New Bond Street, Worcester 6, Mass. Canadian Representative: A. P. Green Fire Brick Co., Ltd., Toronto 5, Canada.

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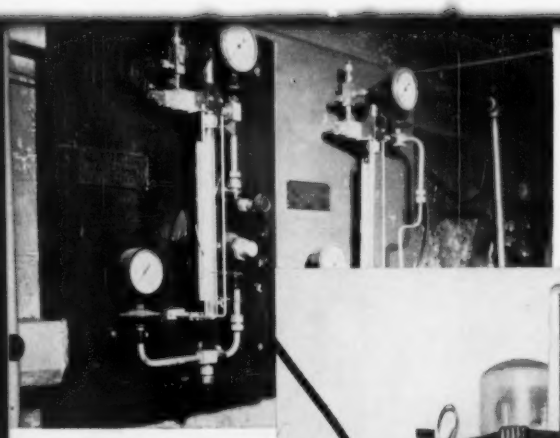
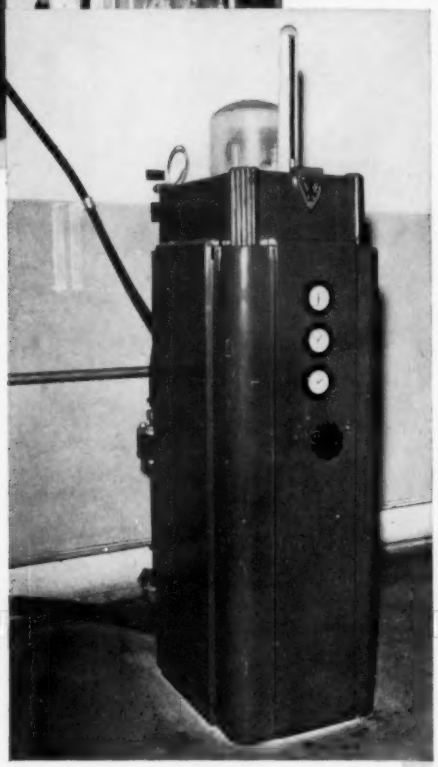


W & T 1919 type
mechanical diaphragm
chlorinator



Modern W & T type
water diaphragm
chlorinator

CITY OF LYNCHBURG, VIRGINIA

June 24, 1955

Wallace & Tiernan, Incorporated
213 Carlton Terrace Building
Roanoke 13, Virginia

Gentlemen:

The first Wallace and Tiernan Chlorinator was installed in Lynchburg in 1919. Subsequently four additional chlorinators have been added as the need has developed. All being W & T equipment.

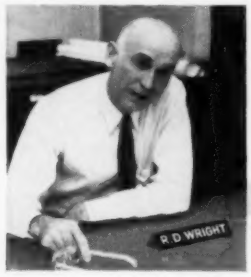
In addition to the Chlorinators we have one Wallace and Tiernan Fluoridator installed in 1951.

The application of chemicals in Lynchburg is more or less unique, in that we have to apply against head at all times. This condition makes it necessary that all chemicals be applied in solution.

In all of our transactions with your organization for more than thirty-five years we have found your service and technical advice available at all times. Your equipment has stood up under what we believe to be adverse conditions, and its performance has been very satisfactory.

Very truly yours,

R. D. Wright, Director
Water Department



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Mr. R. D. Wright, Director, City of Lynchburg Water Department writes, "Your equipment has stood up under what we believe to be adverse conditions, and its performance has been very satisfactory." Lynchburg, Virginia has been using Wallace & Tiernan Chlorinators since 1919. *The original units are still in service*, along with more modern W&T equipment.

When you purchase a W & T Chlorinator, you purchase more than apparatus. You buy experience. Experience that brings you equipment design and materials of construction that have been selected and proven by years of use.

Lynchburg is not the exception. When your W&T representative visits you he can tell you about W&T chlorinators in your area, which are still giving dependable service after years of use.

"Make Your First Choice Equipment That Lasts."

WALLACE & TIERNAN INCORPORATED

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